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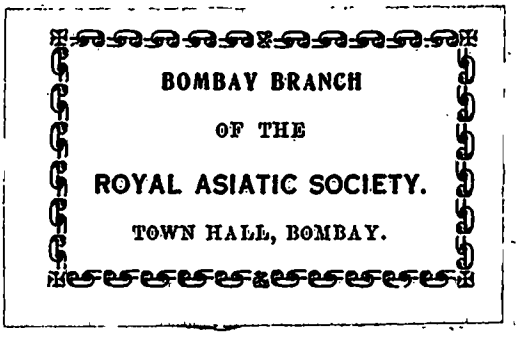

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HANDBOOK

OF

ZOOLOGY.

HANDBOOK

OF

ZOOLOGY

BY

J. VAN DER HOEVEN,

PHIL. NAT. ET M.D. PROFESSOR OF ZOOLOGY IN THE UNIVERSITY OF LEYDEN, KNIGHT OF THE ORDER OF THE DUTCH LION AND OF THE SWEDISH ORDER OF THE POLAR STAR, MEMBER OF THE ROYAL ACADEMY OF SCIENCES, OF THE DUTCH SOCIETY OF SCIENCES AT HAARLEM, OF THE IMPERIAL LEOPOLDO-CAROLINE ACADEMY, OF THE IMPERIAL SOCIETY OF NATURALISTS AT MOSCOW, CORRESPONDING MEMBER OF THE BRITISH ASSOCIATION, OF THE ROYAL ACADEMY OF SCIENCES AT TURIN, OF THE IMPERIAL ACADEMY OF MEDICINE AT PARIS, ETC.

Trado quæ potui.

IN TWO VOLUMES.

VOLUME THE SECOND.

(*VERTEBRATE ANIMALS.*)

TRANSLATED FROM THE SECOND DUTCH EDITION

BY

THE REV. WILLIAM CLARK, M.D. F.R.S. &c.

LATE FELLOW OF TRINITY COLLEGE, AND PROFESSOR OF ANATOMY IN THE UNIVERSITY OF CAMBRIDGE.

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TO

RICHARD OWEN, Esqr. F.R.S. &c. &c.

My dear Sir,

I beg leave to offer you a joint tribute. The author of this work expresses much satisfaction that the translation of it is dedicated to one whom he so greatly respects and admires. To myself it affords peculiar pleasure to present to you, in an English dress, The Handbook of Zoology of one so learned, which, appealing in so many of its pages to the authority of your works, recalls those epochs of still increasing lustre in that distinguished career which is the admiration of the cultivators of that and the allied branches of natural science throughout the world.

That you may long enjoy in health and happiness your well-won laurels is the sincere wish of your friend and admirer

THE TRANSLATOR.

Cambridge,
Feb. 10, 1858.

PREFACE.

To a work comprising such an extensive body of science as the *Handbook of Zoology* of Prof. VAN DER HOEVEN, it is impossible that in a few years or even months much matter for additions and corrections should not be presented. It is clear, moreover, that the printing of a book of more than 800 pages, like the first volume of the English Translation, cannot be completed in a few weeks. The English translator, therefore, could not avail himself of the contributions of Prof. LEUCKART who, in the beginning of 1856, gave a supplement to the first volume of the German edition (*Nachträge und Berichtigungen zu dem ersten Bande von* J. VAN DER HOEVEN'S *Handbuch der Zoologie*, printed after the translation of the second volume, Leipzig, Leopold Voss, 1856). At the date of that publication the greatest part of the first volume of the English edition had been already long printed. From the same cause also reference to the second edition of Prof. OWEN'S *Lectures on the Compar. Anatomy and Physiology of the Invertebrate Animals*, was for the most part impossible.

The English translator, however, gave in the body of the first volume additions and remarks in great part similar to those which are to be found in LEUCKART'S comprehensive review of the progress of Zoology during the six or seven years subsequent to the publication of the first volume of the original. In the chapter on the Infusorics he made a large use of Prof. STEIN'S observations. Amongst these the affinity asserted to exist between *Vorticellæ* and *Acinetæ* would seem to have been disproved by Dr LACHMANN (MUELLER'S *Archiv f. Anat. u. Physiol.* 1856, pp. 340—398), who followed the roving embryos from Acinetæ until, having fixed themselves, they lost their cilia and developed the peculiar suctorial

processes that distinguish this family. On the other hand M. J. D'UDEKEM (*Mém. sur le développement des Infus.* in *Mém. de l'Acad. de Bruxelles* 1857) has shewn that *Epistylis plicatilis* in the course of its multiplication by metamorphosis, does pass through the form of Acineta, and in it develops an internal ciliated germ. At all events, it is established by different observers that, in addition to multiplication by fission and gemmation, infusories also propagate embryos in the formation of which the nucleus is concerned.

Prof. LEUCKART would reject the first and third of VAN DER HOEVEN'S orders of Infusories, excepting only the *Peripkrygana* which, by a modification of the definition of the fourth order he would receive into it, the rest being referred to lower forms of *Algæ*, &c. But this proceeding would seem to be premature, for a number of the *Atricha* have been seen to take in food, as by COHN, *Nov. Act. Acad. Leop. Car.* XXII. P. I. p. 182, and LACHMANN l. l. p. 167, in Monads and Cryptomonads, and J. MUELLER and others in *Bodo grandis* or an *Astasia*. In the former the mouth was observed close to the insertion of a flagelliform appendage and the vent at the posterior extremity. According to LACHMANN at least one contractile vesicle may be seen in all the transparent individuals of this family, whilst a similar vesicle has been observed by BUSK in *Volvox* (*Quarterly Journ. of Microscop. Soc.* I. 1853) and by CLAPARÈDE in several species of *Euglena*. LACHMANN contends that no such pulsating spaces have been found hitherto in any vegetable cell or in the spore of any undoubted plant (l. l. p. 369), and he agrees with SCHNEIDER that creatures thus constituted ought to be placed amongst animal Infusories until it be distinctly shewn that such organs exist also in undoubted vegetable cells. See A. SCHNEIDER *Beiträge zur Naturgesch. der Infusorien* in MUELLER'S *Archiv* 1854, pp. 191—207.

The argument for the animal nature of all organisms presenting pulsatory spaces is strengthened by the fact that in very many instances vessels have been shewn to be in connexion with these spaces or vesicles, and hence by the probable inference that where there is a pulsatory vesicle there also a vascular system exists.

The opinion of O. SCHMIDT, *Vergl. Anat.* p. 250, that the pulsatory vesicle opens externally, has not been confirmed by other observers; and appears to be directly contradicted by what is seen

in *Actinophrys Eichhornii*, where it lies close to the surface. See CLAPARÈDE *Ueber Actinophrys Eichhornii* in MUELLER'S *Archiv*, 1854, pp. 398—419.

No notice was taken by the translator of an order of minute parasites, the *Gregarinæ*, which may be most naturally arranged amongst the Infusories after the *Rhizopoda*. They were discovered by LÉON DUFOUR in the intestine of insects (*Forficula*, *Melasoma*, &c.), and were so named by him on account of their congregating in numbers. They are of various form, round, oval, elongate; consist of an external, structureless, elastic membrane, and a fluid content in which innumerable granules of various form and size are embedded, whilst within the granular mass a circumscribed body with one or more opaque spots, the so-called nucleus, is found. There is neither mouth nor vent.

There are two families of *Gregarinæ:* 1, *Monocystidæ* of STEIN, where the animals are solitary; 2, *Zygocystidæ*, where two individuals are conjoined. The *Monocystidæ* have for their type the simple animals found abundantly in the space between the skin and the intestine in the earth-worm and in the testes. The *Zygocystidæ* contain two genera: 1, *Gregarina* LÉON DUFOUR; 2, *Stylorhynchus* STEIN, with a proboscis which is sometimes surrounded by a circle of hooklets.

STEIN believed that the *Gregarinæ* are propagated by the conjugation of two individuals which become included in a common cyst. From this intimate union arise spores (*Pseudonavicellæ*, *Spindle-cells*, *Psorospermiæ*), which after a time allow new individuals to escape. But although two individuals are often thus included in the same cyst, a process like that of the conjugation of cryptogamous plants does not occur, for the psorosperms are equally produced when only a single *Gregarina* is encysted. The process begins with the disappearance of the nucleus, and consists of many stages, according to N. LIEBERKUEHN (*Évolution des Grégarines* in *Mém. couronnés des Sav. Étrang., Acad. Roy. de Bruxelles*, 1855). This author concludes from his observations that instead of the *Gregarinæ* escaping directly from the shell of the *Psorosperms*, *Amœbæ* are the product, and that finally these *Amœbæ* are transformed into *Gregarinæ*. All the successive stages are to be seen in the testes and abdominal cavity of the Earthworm, where chiefly they were studied by LIEBERKUEHN.

On the *Gregarinæ* see in addition LÉON DUFOUR *Ann. des Sc. nat.* XIII. pp. 366—368; FRANZIUS *Observationes quædam de Gregarinis*, Berolini, 1846, and in WIEGMANN'S *Archiv f. Naturgesch.* XIV. s. 194, &c., STEIN in MUELLER'S *Archiv*, 1848, pp. 182—223, KOELLIKER in KOELLIKER *u.* SIEBOLD'S *Zeitschr. f. wissensch. Zool.* I. pp. 1—37, with a description of many species, LEIDIG in MUELLER'S *Archiv*, 1851, *Ueber Psorospermien u. Gregarinen*, pp. 221 and 223.

Many authors are now disposed to refer the sponges to the animal kingdom. This opinion of LAMARCK was afterwards supported by GRANT, MEYEN and L. LAURENT, and to this conclusion tend also the observations recently published by N. LIEBERKUEHN on the development of the fresh-water *Spongillæ*.

Sea-sponge (*Spongia* L.) consists of a loose, porous, horny mass, formed of fine unjointed, branching threads more or less transparent. In fresh-water sponge (*Spongilla lacustris*) the frame-work is formed of fine spicula in which a green granular mass is disposed, whilst in this at certain times of the year small round masses are seen, the so-named gemmules. These are cysts of spongillæ; when the envelope bursts, the spongillar mass creeps forth and afterwards develops tubular processes. Besides these there are ciliated embryos, which after a while attach themselves and lose their cilia. These young spongillæ soon develop a tubular process with an aperture capable of being closed and opened. There are ova also with a germinal vesicle and spot and spermozoïd bodies which are formed in fixed capsules. It seems uncertain where this addition to the animal kingdom is to find its true relation. Doubtless it has some analogy with the *Rhizopoda*, pp. 45, 46. If the sponge be not a colony but an individual, then the relation to the *Rhizopoda* would be best illustrated by that between *Actinia* and *Fungia* amongst the *Anthozoa*. LAMARCK considered the sponges to be colonies, polyparies with unknown inhabitants, and placed them with *Alcyonium* (not to be confounded with *Lobularia* LAM., *Alcyonium* of recent authors) amongst the *Polyparia porosa* or *Polypiers foraminès*.

On the sponges may be cited: LAMARCK *Hist. nat. des Anim. sans vertèbres*, 2e edit. par M. DESHAYES *et* MILNE EDWARDS, II. pp. 529—590, 1836, Papers of GRANT in the *Edinb. Phil. Journal*, XIII. p. 94, p. 333, XIV. p. 113, p. 336, *On spongia friabilis*, XIV. p. 270, *On Calcareous Sponges, Ed. Phil. Journ.* New Ser. I. p. 166, *On Silicious Sponges*, ibid. p. 341, *Hist. of British Sponges*, by GEORGE JOHNSTON, Edinb. 1836, MEYEN *Beiträge zur näheren Kenntniss unseres süss-wasser Schwammes* in

MUELLER'S *Archiv*, 1839, pp. 83—89, LAURENT *Recherches sur l'Hydre et l'Éponge d'eau douce*, Paris, 8vo, av. Atl. fol. (1844), N. LIEBERKUEHN *Beiträge zur Entwickelungsgeschichte der Spongillen* in MUELLER'S *Archiv*, 1856, s. 399—414, s. 496—514, CARTER *on Spongilla* in *Ann. and Mag. of Nat. Hist.* 2nd Ser., XVIII. p. 242, and ibid. XX. p. 21 and foll.

To the works on the *Rhizopoda*, cited Vol. I. p. 47, may be added by MAX SCHULTZE *Beobachtung ueber die Fortpflanzung der Polythalamien* in MUELLER'S *Archiv*, 1856, pp. 165—173, from which it appears probable that the shell of the young animal is formed within the body of the mother; and by CARPENTER *Researches on the Foraminifera* in *Phil. Trans.* 1856, I. pp. 181—236.

The *Hydra-form* polyps are placed by LEUCKART in nearer relation to the *Acalephs* under the name of *Hydrasmedusæ;* but the great affinity between these animals had already been noticed by VAN DER HOEVEN at p. 70 of the first volume: "It is possible that all hydra-form polyps may be only imperfect forms of *Medusæ*.... At all events the perfect form of *Hydra* would then be unknown." Amongst the sea-nettles (*Acalephæ*) most of the important disquisitions of LEUCKART, VOGT and others, shewing that the *Siphonophoræ* are compound organic bodies (as had already at a previous period been the opinion of DELLE CHIAJE and MILNE EDWARDS respecting some of them), were duly related at p. 102 and foll. So also in the class of the *Echinoderms*, the investigations on the metamorphosis by Prof. JOH. MUELLER up to the date of the English translation were supplied by the translator, pp. 137, 138. To the memoirs of MUELLER, cited p. 138, must now be added another, *Ueber die Gattungen der Seeigellarven. Siebente Abhandlung ueber die Metamorphose der Echinodermen.* Mit 9 Kupfert. Berlin, 1855 (*Königl. Akad. der Wissensch. zu Berlin, Jahrgang* 1854).

One of the most questionable points in the classification of invertebrate animals is the true position of *Bryozoa* (called also by Prof. ALLMAN and other, chiefly English, Naturalists, after THOMPSON, *Polyzoa*). LEUCKART seems to hesitate whether they belong to the worms in the vicinity of the *Rotatoria* or to the molluscs. It seems indeed better to form of them a separate class, and not to unite them to the Polyps. If, however, this class be placed near the *Tunicata* in the great type of the *Mollusca*, in that case as many objections might be urged[1] as are now advanced by different writers against their union with the anthozoic type. There must always be

[1] See OWEN *Lectures*, &c. sec. edit. I. p. 154.

something of arbitrary selection with respect to the position of osculant groups in a systematic arrangement.

To the citations on *Bryozoa* add ALLMAN, *Monograph on the Fresh-water Polyzoa, Ray Soc.* 1856.

In the class of *Entozoa* the most important discovery of modern times consists in the demonstration that the *Cystica* are only imperfect conditions of *Cestoïdea*, of *Tænia*. It is hoped that the English reader will be satisfied with the important additions at pp. 173—176, and p. 181. It must not be omitted however that the statement of V. SIEBOLD, p. 175, that the different forms of *Cœnurus* and *Cysticercus* depend upon the locality assumed by the embryo and not upon original difference of the *Tæniæ* of which they are the the progeny, is not tenable. For LEUCKART has found that though *Cysticercus pisiformis*, *C. tenuicollis* and *Cœnurus cerebralis* are all developed into *Tæniæ*, called collectively *Tænia serrata*, when swallowed by a dog, yet that the first and third at least of these species certainly differ in the number and form of the hooklets and in other respects; and also that a sheep is not rendered vertiginous by swallowing the eggs of *Tænia solium*, or of *T. pisiformis*. Hence *Tænia solium* and *T. serrata* are different species.

KOELLIKER in his *Zeitschr. f. Wissensch. Zool.* IX. 1857, p. 139, confirms, in the *scolex* of a tape-worm from *Murœnophis saga*, the existence of many free openings externally of the vascular system already observed by WAGENER (*Nov. Act. Nat. Cur.* XXIV. *Suppl.* pp. 16 and 33), as stated by KOELLIKER.

It has been already related, p. 188, that *Pentastoma* ought to be removed from the *Entozoa* and placed amongst the parasitic *Crustacea Lernæacea*. See chiefly the memoir of the first discoverer of the young form, Prof. VAN BENEDEN, cited p. 625.

It appears that Prof. VAN DER HOEVEN is of opinion that the *Acanthocephala*, p. 184, would stand more properly after the *Trematoda*, p. 188, intermediate between these and the *Nematoidea*.

With respect to the place of the *Rotatoria* in the systematic arrangement, many memoirs have been recently published in V. SIEBOLD *u.* KOELLIKER'S *Zeitschr. f. wissensch. Zool.* by LEYDIG (VI. 1854), C. VOGT (VII. 1855), and H. BURMEISTER (VIII. 1856). But the result of all these discussions seems to lead to no other conclusion than that they form a class of low-developed, articulate animals, allied to the ringed worms and the inferior forms of *Crustacea*,

I. p. 196. The distinct sexuality (p. 197, 198) of this class has been further extended by COHN, who has also discovered a second mode of propagation by the so-named winter-eggs. See his paper *Ueber die Fortpflanzung der Räderthiere*, in Y. SIEBOLD and KOELL. *Zeitschr.* VII. p 431—486.

The very difficult investigation of the generative system in several of the abranchiate ringed-worms has of late years engaged the attention of M. D'UDEKEM. In *Lumbricus terrestris* he has made the discovery of the ovaria and ova hitherto unknown. The ovaries are extremely minute vesicles situated one on each side of the nervous chord in the 12th ring of the body. They are pear-shaped, closely united to the membranes of the chord by their anterior broad extremity and terminate backwards in a canal, the oviduct, which is believed to open with the vas deferens, but was too delicate to be followed to its termination. The ova are quite microscopic. The testes are six in number, three on each side of the intestinal tube, the anterior pair in the 8th ring, the middle pair in the 9th ring, the posterior and largest pair in the 10th and 11th rings. Between the testes and the mid-plane are two ciliated infundibula, with the anterior of which the two anterior testes communicate, with the posterior the posterior testis. The two infundibula on each side are the internal extremity of canals which, after many convolutions, unite to form a vas deferens, which runs backwards to terminate in a transverse orifice on the 15th ring. There are also accessory organs: two hollow spherical bodies on each side attached to the ventral wall by a short pedicle, which is the duct by which they open externally; these were supposed by DUGÈS and others to be the testes on account of their containing spermatozoa, but are called by D'UDEKEM spermatic reservoirs, having no communication with the interior of the lumbricus, and therefore receiving the spermatozoa from without. The remaining accessory bodies, situated like the last on the outer aspect of the testes, are a variable number of vesicles in pairs from the 8th to the 11th ring; they are setigerous glands modified for the secretion of matter to form capsules for the ova (*glandes capsulogènes*). The earth-worm is oviparous, and the number of ova included in a capsule is 2, 3, 4 or more, though usually one alone is developed.

In *Enchytræus* the testis is single and situated below the intestinal tube; it extends from the 11th to the 13th ring. It has the

form of a vesicle and is completely invaginated in the ovary. There are two openings at its anterior part by which it communicates with the vibratile infundibulum on each side, which is the beginning of the vas deferens; after forming many convolutions each vas deferens opens externally on the ventral surface of the 12th ring. Here also are *glandes capsulogènes*, but they are found at the anterior part between the 5th and 8th rings, and open at the 5th ring on each side.

In *Tubifex rivulorum* and *Nais proboscidea* also the female organs more or less invaginate the male.

See D'UDEKEM *Hist. nat. du Tubifex des ruisseaux, Mém. couronné, Acad. Roy. de Belgique,* XXVI. 1855, by the same, *Développement du Lombric terrestre,* ibid. XXVII. 1856.

In this class the distinction between blood, generally red-coloured and contained in close vessels, and the nutrient fluid of the general cavity of the body (*chylaqueous fluid* WILLIAMS), becomes marked. The blood contains no corpuscles, these are confined to the fluid that circulates in the visceral cavity, which is the product of digestion mixed with water. The form of the corpuscles is various, is least constant in the lower classes, where the chylaqueous is the sole nutrient fluid, but even in the molluscs does not attain the regularity of form which prevails in the lower vertebrates. These corpuscles in many of the *articulata*, when removed from the body, send out processes like *Amœba*, and are supposed by N. LIEBERKUEHN to be parasites. It is from the fluid of the peritoneal cavity that the blood derives nutrient matter.

See on this subject: QUATREFAGES *Mém. sur la cavité générale du corps des invertébrés, Ann. des Sc. nat., Ser.* III. Tom. XIV. pp. 302—320; WHARTON JONES, *The blood-corpuscle considered in its different phases of development, Mém.* II. *Invertebrates,* in *Phil. Trans.* 1846, pp. 89—101; WILLIAMS *On the British Annelida* in *Report of Brit. Association for* 1851, pp. 159—272, describing the blood-circulation and his views also of the generative system in *Lumbricus, Hirudo* and *Nais,* for which see also, RYMER JONES *Animal Kingd.* edit. 2, pp. 272—275, pp. 282—284, pp. 287—289, and WILLIAMS *On the blood proper and chylaqueous fluids of invertebrate animals, Phil. Trans.* 1852, pp. 595—653; the same *On the Mechanism of Aquatic Respiration* in *Ann. and Mag. of Nat. Hist.* 2nd Ser. Vols. XIV, XVI, XVII.

In the class of insects Prof. VAN DER HOEVEN is of opinion that the order *Strepsiptera* pp. 305—307 might conveniently be suppressed. In all the genera included in it there appears to be the

greatest affinity with *Mordellona* p. 501 (*Rhipiphorus* and *Symbius*, p. 502), to which indeed BURMEISTER (*Handbuch der Naturgesch.*, 1837, p. 343) had already referred them, and afterwards also SHUCKARD, and more recently NEWMAN *Zoologist*, 1850, pp. 2684—2694.

The multiplication of insects without previous copulation was noticed in *Aphis* at pp. 263, 264. It has been observed in other instances, as in *Lepidoptera* and in *Bees*, but under different circumstances. In *Aphis* the parent is imperfectly developed, there is neither *bursa copulatrix* nor *receptaculum seminis*. In the others both these organs are complete. The eggs laid by the virgin queen-bee always produce males: those which are impregnated produce females (working bees or queens); the queen has the power at will of laying an egg that shall produce a male or a female, *i.e.* she can during oviposition impregnate the egg with spermatozoa or not. In *Bombyx mori* SIEBOLD found that only few of the unimpregnated eggs are productive, and that from these males or females proceed indiscriminately. In *Psyche* it was males that required impregnated eggs for their production.

See OWEN *On Parthenogenesis*, London, 1849 and V. SIEBOLD *Wahre Parthenogenesis*, Leipzig, 1856.

In the *Crustacea* the remarkable discoveries of DARWIN respecting the *Cirripedia* were referred to by the translator at pp. 608, 609, and 635—640.

Amongst the Molluscs, with regard to the *Lamellibranchiata*, if Prof. VAN DER HOEVEN had to write his book again he would entirely alter the order of succession of the families.

What had become known respecting the *Hectocotylus* of dibranchiate *Cephalopods* was recorded by the translator at pp. 821—823.

With regard to the second volume of this work the translator has made few additions beyond the notice of the principal fossil reptiles at pp. 321—327. But such large additions and alterations have been contributed by the author himself, particularly in the class of Fishes and that of Reptiles, that this volume may be regarded rather as a third edition of the original, than simply a translation of the second.

At p. 37, note 1 it is stated that in the class of fishes alone the existence of *corpora Wolffiana* had not been ascertained. This

class now ceases to be an exception to the rest of the vertebrates in this respect. The primordial kidneys have been demonstrated in the early period of the fish-embryo by REICHERT. See his paper *Ueber die Mueller-Wolff'schen Körper bei Fischembryonen in* MUELLER'S *Archiv*, 1856, pp. 125—133.

It is to be much regretted that the original and highly valuable memoir of Prof. OWEN *On the characters, principles of division, and primary groups of the class Mammalia* published in the *Proceedings of the Linnean Society* for 1857, should have made its appearance at a period too recent to admit of that general discussion of it by Zoologists, which in the opinion of the author of this work ought to precede the adoption of any great change in the systematic arrangement. The memoir contains in its preliminary portion a condensed view of the author's various determinations respecting the dental characters of the class. It will be found that full use has been made of these in the characters of the genera in the present volume.

In this memoir the fourfold primary division of the mammalian class is founded upon the four leading modifications of the cerebral system. In some mammals the cerebral hemispheres are only partially connected by the *fornix* and the anterior commissure; in the rest of the class the *corpus callosum* is added.

Those in which the *corpus callosum* is absent are the implacental or marsupial mammals. This first group includes the *Lyencephala*, so called from the comparatively loose and disconnected state of the cerebral hemispheres. The hemispheres, again, are so small that the olfactory ganglions and cerebellum are exposed, and more or less also of the optic lobes. The surface of the hemispheres is generally smooth.

In the next stage of development of the brain the *corpus callosum* is present, but connects hemispheres not exceeding those of the former class in bulk and external character; there are no convolutions, except in a small number of the largest members of the group, where they are simple and few. In this subclass the *testes* are either permanently or temporarily concealed in the abdomen; there is a common genito-urinary aperture in most; there are two anterior *venæ cavæ* terminating in the right auricle of the heart, with other remarkable indications of resemblance to birds and reptiles. These are named *Lissencephala*.

The third leading modification of the mammalian cerebrum is such an increase in its relative size that it extends over more or less of the cerebellum, and generally over more or less of the olfactory lobes. Except in a few inferior forms of the *Quadrumana* the superficies is folded into convolutions, whence this third sub-class is named *Gyrencephala*. As a general rule there is a scrotum; the vulva is externally distinct from the anus. With the exception of the elephants, there is a single anterior cava.

In man the hemispheres overlap the olfactory lobes and the cerebellum; their posterior large development includes the posterior horn of the lateral ventricle and the *hippocampus minor*. Man forms a distinct sub-class, *Archencephala*.

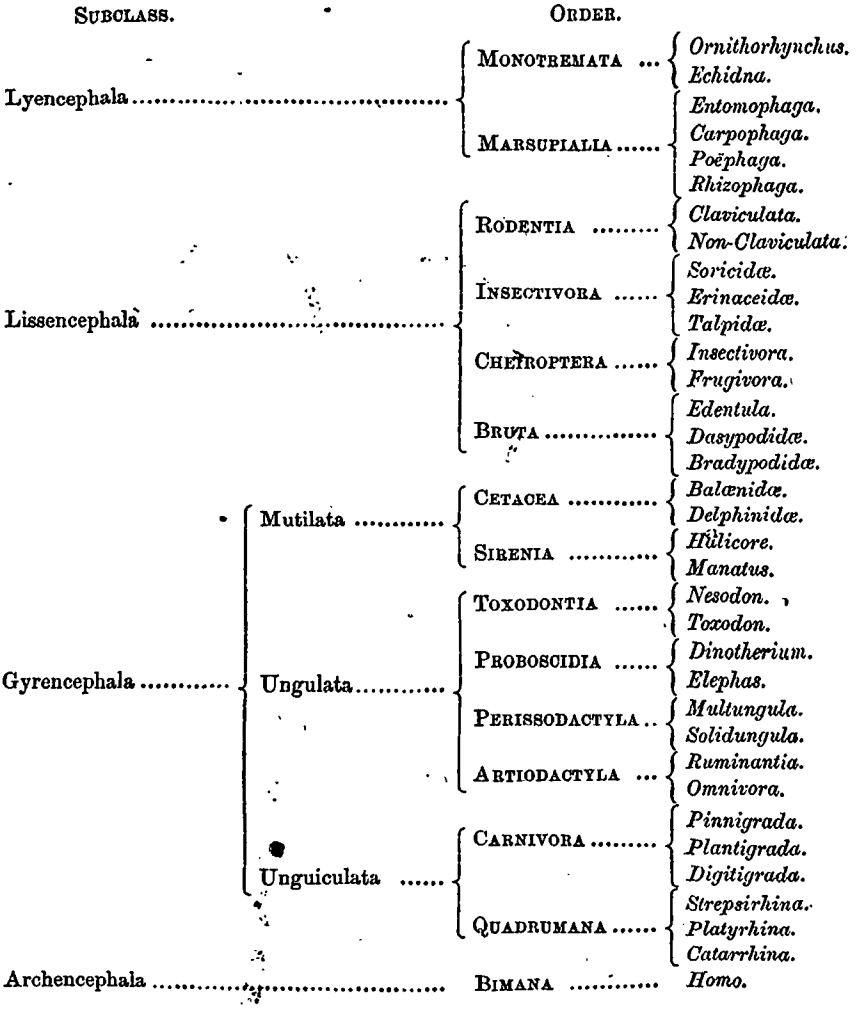
For the definitions of the secondary groups of these four primary diseases the memoir itself is referred to.

Prof. OWEN's Table of the Subclasses and Orders (reversed to facilitate comparison with the arrangement of the present work) is annexed.

W. C.

CAMBRIDGE,
Feb. 10, 1858.

CLASS MAMMALIA.



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ERRATA AND CORRECTIONS.

Additional in Vol. I.

Page	Line	
283	20	from top, for *antennæ* read *muscles*.
317	5	from bottom, for *Condylura* read *Cordylura*.
347	14	from top, for *under* jaws read *upper*.
385		before l. 26, Family XXIII. insert: B. *Phytophaga.* Abdomen sessile. Larva furnished with six or numerous feet (to correspond to section A. *Entomophaga*, p. 371).
556		note, l. 15, 17, for HANN read HAHN.
604	1	for *Parabœa* read *Porcellio*.
769	5	from bottom, for *probable* read *improbable*.

In Vol. II.

17		after last line of note 2, add Berolini, 1847, 4to.
26	7	from bottom, for *Geschied.er* read *Geschieden*.
37	21	for *Sphyrna* read *Sphyra*.
53	14	from bottom, for *Ammodotes* read *Ammodytes*.
62	16	from bottom, for *aguila* read *aquila*.
[illegible]	5	insert: †† *No spur at the base of tail* (compare p. 62, l. 7).
71	15	from top, for 76—78 read 69—78.
72	1	for KILTARY read KITTARY.
73	3	note, for *Frieslebenense* read *Freislebenense*.
,,	4	note, for *Frieslebeni* read *Freislebeni*.
78	7	from bottom, for RANZINI read RANZANI.
82	13	and 9 from bottom, for *Panserwelse* read *Panzerwelse*.
84	17	for *five* rays read *three*.
92	9	from bottom, for AGARS read AGASS.
135	1	for *Xyrichthys* read *Xirichthys*.
262	7	from bottom, for *Merrem* read MERREM.
266	17	from bottom, for *Opisthoglyptes* read *Opisthoglyphes*.
319	17	from bottom, *Cistuda:* is not this a misprint in FLEMMING'S work for *Cistula?*
555	1	for *Philodota* read *Pholidota*.
615	12	and 5 from bottom, for *Dendrologus* read *Dendrolagus*.

ON THE LAST FOUR CLASSES

OF THE

ANIMAL KINGDOM

IN GENERAL.

We have already seen (Vol. I. p. 32) that modern Zoologists, in imitation of Lamarck and Cuvier, unite the Fishes, Reptiles, Birds and Mammals, under the common name of vertebrate animals, to form a large division of the animal kingdom. In these animals the main trunk of the nervous system, the spinal cord and the brain, is inclosed in a bony or cartilaginous cavity, which is usually formed of distinct rings or vertebræ.

The muscles are almost all inserted into internal supports, which, together with the hard investiture of the brain and spinal cord, form what is called the frame-work or skeleton. The body has in general a symmetrical form on the two sides, and is divided by an imaginary axis into a right and left half, in which especially the organs of animal life, the nerves and muscles, are correspondingly formed and placed. There are never more than four limbs present in these animals; some have only one pair of limbs; in others the limbs are entirely absent. Their blood is red[1]. The sexes are always distinct, so that bisexual individuals occur as pathological exceptions alone.

There are always two jaws, one situated above the other, of which the lower especially is moveable. The motion of these parts occurs vertically and not laterally, as is the case in the Articulate Animals. Ordinarily the jaws are armed with teeth; in the

[1] In *Amphioxus lanceolatus* alone has colourless blood been observed; J. Muellek *Ueber der Bau u. die Lebenserschcinungen des Branchiostoma lubricum* Costa, *Amphioxus lanceolatus* Yarrell. Berlin, 1844 (*Physik. Abhandl. der Akad. d. Wiss. zu Berlin*, Jahrgang, 1842).

tortoises and birds a horny covering, and in the whales a row of horny plates (in the upper jaw,—the so-called baleen), takes the place of the teeth which are wanting. Teeth are, as it were, ossified papillæ on the mucous membrane of the jaws; they may also occur on the palate, on the tongue, and, in fishes, on the branchial arches.

The intestinal canal is of various width in different parts, and receives various fluids, which are secreted by different glands. Such a fluid is the saliva, which is mixed with the food during mastication and deglutition, such also the bile and the pancreatic juice. In all vertebrate animals the liver, besides arterial blood, receives also much venous blood, which, as it returns from the viscera, is taken up by a venous trunk (the portal-vein), that like an artery divides into branches to be distributed through the liver.

From the food which has been changed by the action of the stomach and of these secreted fluids, and is called chyme, the chyliferous or lacteal vessels take up the nutritious part, and convey it in a fluid state (called chyle) to the veins. Other vessels, in addition, which resemble the lacteals, but which are not, like these, spread over the intestinal canal, absorb from the different parts of nearly the entire body a watery fluid (lymph), which becomes mixed with the chyle. These vessels, with the preceding, make up the lymphatic system, which appears proper to vertebrate animals alone. They begin with blind extremities, and are formed of an *epithelium*, which is covered by a fibrous membrane formed of filaments running longitudinally and mutually crossing in form of a net. On the outside of this membrane lies a covering of circular fibres which pass into those of the surrounding connective tissue. In the interior of the lymph-vessels, at least in most, are placed in mammals and birds membranous valves, which favour the motion of the fluid from the circumference of the body inwards, towards the larger vessels. In mammals and in man almost the whole fluid of this entire system meets in a principal stem, the thoracic duct, which opens into the left subclavian vein. There are, however, smaller trunks also, which are situated on the right side, and sometimes form connexions with other veins. The lymphatics form repeated networks, and also as in warm-blooded animals, by their rolling up and intertwining, glands improperly so named (*glandulæ conglobatæ*). The spleen is also a part which is found in vertebrate animals alone, and of which the presence and the

function are probably in connexion with those of the lymphatics[1]. This organ is situated in the neighbourhood of the stomach, and thus more on the left side, at the upper part of the abdominal cavity; it consists of a red, highly vascular tissue surrounded by a fibrous external membrane, from which white productions as envelops of the blood-vessels penetrate the internal soft substance and support it like transverse joists. Peculiar vesicles, of microscopic size, filled with a white pultaceous mass (*Malpighian bodies*), are attached to these productions; the red pulpy substance contains many red-brown granules[2].

We have already indicated that the blood of vertebrate animals is red; hence the ancients, though incorrectly, ascribed blood to these animals alone, and called the invertebrates bloodless animals. The veins of the body convey the blood to the heart, from which it is driven to the respiratory organs: that is, the heart of vertebrate animals is venous. In invertebrate animals, on the contrary, the heart is arterial, i. e. it receives those veins which return the blood from the respiratory organs, and sends the blood to the vessels which are distributed to the various parts of the body. In vertebrate animals, an arterial heart also may be present, but never unless at the same time a venous heart be found. The two hearts in that case lie close together (the two ventricles in mammals and birds), or they coalesce to form one cavity, as in most of the reptiles. Thus, whenever the heart receives the veins of the body alone, as in fishes, then there is only one auricle and one ventricle; if, on the other hand, it receives the veins of the body (the *venæ cavæ*), and the veins of the respiratory organs as well, then there are two auricles (*atria*), but not on that account always two ventricles. In those vertebrate animals in which the two ventricles are united to form one cavity, not all the blood but only a part of

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[1] It is asserted that the chyle acquires greater coagulability by admixture of fluid contained in the lymphatics of the spleen. Compare P. W. LUND *Physiologische Resultate der Vivisectionen neuerer Zeit.* Kopenhagen, 1825, 8vo, s. 78—83.

[2] The spleen appears to be absent in the Cyclostomes alone, although a gland situated on each side of the superior orifice of the stomach is referred to it by MEYER and others. Notwithstanding, however, the general presence of the organ in vertebrate animals, it does not seem to be essential to life, but may be excised without danger, as has occurred as well in animals as in man; see the notes in HALLER *Element. Physiol.* VI. p. 421.

it, is conducted to the respiratory organs; arterial blood is mixed with venous blood.

The respiratory organs of vertebrate animals are gills or lungs. Vertebrates alone inspire by the mouth, and such as have lungs exspire by the mouth also.

In all vertebrate animals kidneys are present, parts by which the urine so rich in nitrogen is secreted, and of which the internal structure consists of fine tubules. In the lower vertebrates these tubules unite to form branches which open into excretory ducts (*ureteres*) running along the whole kidney; in birds and mammals they unite to form bundles—pyramids,—which are arranged around the cup-like commencement of the ureters. The two ureters, again, often terminate in a bladder in which the secreted fluid is collected before being discharged.

As to the sexual organs, we have already stated above, that the sexes are constantly distinct. Not by any means, on that account, however, is there a copulation in all, but sometimes the eggs, as in most fishes, are impregnated after they have been laid. The ovary is single or double (paired). In this organ the eggs are formed, and leave it in order to undergo further development in another situation. With most vertebrate animals this situation is external to the body of the mother, and the development depends upon external conditions of light, water and warmth: according to the difference of these conditions the egg may require a longer or shorter period for the development of the germ; the germ alone of a future independent being is present at the time of birth, or of the separation of the egg from the body of the parent animal. In other cases the eggs, so to speak, are brooded within the parent body itself; and here the birth, which terminates the period of fœtal life, is contemporaneous with the relinquishment of the fœtal envelops. Such animals are usually named *viviparous*[1], but the limit between these and the oviparous cannot always be defined with precision. Most fishes and reptiles and all birds are oviparous.

In the yolk of eggs, that still lie in the ovary, there is seen a small transparent vesicle or a cell, which is surrounded by a ring or by a small accumulation of a granular mass. This germ-vesicle,

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[1] BURDACH names these animals *nudipara*, *Die Physiologie als Erfahrungswissenschaft*, II. Leipzig, 1828, s. 45 (2te Auflage, 1837, s. 48).

first accurately indicated by PURKINJE in the bird's egg, also contains a nucleus, to which the name of germ-spot (*macula germinativa*) has been given, and of which the discovery is due to R. WAGNER. The investigations of the latest period have demonstrated the universality of these parts of the ovarian egg. When the egg passes from the ovary into the oviduct, the germ-vesicle disappears, and is replaced by a disciform germ-membrane from which the first development of the *embryo* takes a beginning. In mammals, as early as the latter end of the seventeenth century, the vesicles of the ovaries had become known through the investigations of REGNERUS DE GRAAF, which after their discoverer were named *folliculi graafiani*, and were generally regarded as eggs. But only about twenty years have passed since VON BAER found the true egg in the ovary of mammals, which, however, he took for the germ-vesicle then lately discovered by PURKINJE, and thought that in mammals alone this vesicle passes from the ovary into the oviduct, whilst in oviparous animals the entire egg, the yolk, is taken up by the oviduct. Consequently, according to VON BAER, the *folliculi graafiani* were to be regarded as ovarian eggs, which inclosed within them the *ovum fetale*, the germ-vesicle[1]. It was afterwards[2] discovered that this so-named *ovum fetale* also included within it a germ-vesicle; in other words, that it was a perfect egg, which was still further confirmed by the discovery of the germ-spot in this vesicle. The *folliculi graafiani* are thus not eggs, but each of them contains an egg which occupies only a small space of it, but yet in its composition, in its inclosing a germ-vesicle with its germ-spot, is similar in form to the egg in the ovary of birds and other animals.

On development the germ lies, as in invertebrate animals, in form of a gelatinous disc on the yolk, immediately under the vitelline membrane. The germ-disc separates into three layers; a serous layer the most external, a mucous layer the most internal, and a vascular layer between the two, but more intimately connected with the mucous layer. In the middle part of the serous layer arise the vertebral column, the spinal marrow and the cerebral mass. On the outer surface of the serous layer arise two projecting lines, which

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[1] C. E. A. DE BAER *De Ovi Mammalium et Hominis genesi*. Lipsiæ, 1827.

[2] COSTA, WHARTON JONES, VALENTIN, BERNHARDT enz.

afterwards unite above and enclose the spinal marrow. Beneath, this layer bends itself round in order to form the abdominal cavity. The mucous layer gives origin to the intestinal canal.

It is worthy of remark that the position of the *embryo* with respect to the yolk differs from that in the articulate and other invertebrate animals. In these the yolk lies on the dorsal surface, in the vertebrate animals always on the abdominal surface of the *embryo*. The central portion of the germ, from which the development begins, is, in vertebrate animals, the dorsal part. Hence it arises also, that if we suppose the intestine to be the axis by which the body is divided longitudinally, the principal mass of the nervous system, the stem—the brain and spinal marrow—lies above this axis, whilst the gangliated cord of articulate animals which corresponds to the spinal marrow lies under its axis, on the abdominal surface; the spinal marrow is here replaced by an abdominal cord. Inversely the heart in vertebrate animals lies below, in invertebrate animals above the same axis[1]. We have seen above that the *dorsal vessel* of insects takes in them the place of a heart (compare Vol. I. p. 258).

The position of the central part of the nervous system (the spinal cord and brain) on the dorsal surface, and its enclosure in a special cavity distinct from that of the viscera, form two principal characters of vertebrate animals. If we follow the branches from which the nerves of the skin or those of the muscles arise to their origin in larger and still larger trunks, then we find that they all run towards the brain or the spinal marrow, and lose themselves in the substance of these parts. Brain and spinal marrow are consequently the central parts of the nervous system of animal life. They are, however, only two divisions of one and the same whole, of which the development and magnitude are usually inversely proportional to each other. In the most perfect vertebrate animals, namely the mammals and especially in man, the mass of the brain far surpasses that of the spinal cord.

In the brain and in the spinal cord the nerve-substance appears under two modifications. Chemical investigation has

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[1] Compare H. RATHKE *Untersuchungen über die Bildung und Entwickelung des Flusskrebses.* Leipzig, 1829, s. 77—90; see also BAER *De Ovi Mammal. et Hominis genesi*, p. 24.

hitherto indicated no remarkable difference between them; only the one seems to contain less fat, a softer albumen[1], and more water. This is of a grey colour and receives a greater quantity of blood-vessels than the other, which is white and is named *medullary substance* (comp. Vol. I. p. 11). This denomination and that of *cortical substance* are derived from the relative position of the two substances in the brain, where usually the white substance is surrounded by the grey. In the whole of the spinal marrow on the contrary the cortical substance is situated internally.

In vertebrate animals two nervous systems may generally be distinguished, one for the vegetative, another for the animal life, although many invertebrate animals also, as we have formerly noticed, already indicate a commencement of this division[2]. On the other hand, in some vertebrate animals the *nervus sympathicus* is little developed, and is in part replaced by the *vagus*. The nerves of vegetative life unite in irregular flat or round bodies which are named nerve-ganglia. Here the branches of nerves form many nets or plexuses, which principally surround the blood-vessels. The whole is destitute of symmetry.

In proportion to the larger development of the nervous system, the organs of the senses in vertebrate animals are also more perfect. Four of these, the organs of sight, hearing, smell and taste, are situated in the anterior part of the head, included in bony cavities and protected. The olfactory organ, formed by a folded mucous membrane upon which the branches of the first pair of nerves are spread out, is in most fishes entirely segregated and placed on the upper surface of the bony head, but in those vertebrates that breathe by lungs is connected behind with the cavity of the mouth, and so with the respiratory organs. The sense of feeling (and more particulary that of tact) is in some animals especially developed in the fingers, in others in the lips, in others again probably in the tongue. Eyes are always present, as it would seem, in vertebrate animals, although they are often very small and sometimes concealed under the skin, and in certain fishes are two little balls surrounded by pigment without refracting media, and so can have no other office than that of distinguishing light.

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[1] JOHN *Chemische Tabellen des Thierreichs*, s. 7.

[2] See Vol. I. p. 766.

An especial characteristic of vertebrate animals consists in the possession of an internal skeleton, of which the spinal column forms the stem. However strange it may sound, it is nevertheless true that all vertebrate animals do not possess vertebræ. The first commencement of the skeleton is a cord situated in the back, which is sometimes fibrous but usually gelatinous, and consists of elongated cells, and is inclosed invariably by a fibrous sheath. This cord (*chorda dorsalis*) does not undergo ossification, but during the formation of the bony vertebræ is gradually superseded or included by the ossified sheath. At the same time there are imperfect fishes where this dorsal cord is persistent, and where no special vertebræ are found. The spinal marrow lies above this cord, protected by two fibrous laminæ, or by cartilaginous arches. Consequently a vertebral column cannot be assigned as the universally prevalent type of vertebrate animals, but first of all a dorsal cord (*chorda dorsalis*) which either persists during the whole of life, or is replaced by a vertebral column; and next, a spinal marrow, as central mass of the nervous system, which is situated upon this cord or upon the vertebral column.

The basal pieces of the cranial bones, upon which the mass of the brain rests, resemble the bodies of vertebræ. The brain is surrounded by very wide vertebral arches[1]. All the cranial bones however do not arise from ossification of the original cartilage which is to be regarded as a continuation of the vertebral column in the head. This cartilage, this primordial skull, is in part covered over and inclosed by bones which arise from a membranous *blastema* which lies upon the cartilage, and so have never been cartilaginous[2]. In general all fibrous and tendinous parts may become bony. Hence the muscles of the legs in birds are seen to terminate in bony tendons; in other animals portions of bone are found in the diaphragm,

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[1] OKEN adopts three cranial vertebræ: *Ueber die Bedeutung der Schädelknochen.* Jena, 1807, 4to; OWEN four: *On the archetype and homologies of the Vertebrate Skeleton.* London, 1848.

[2] Attention was directed to this point by the celebrated physiological anatomist L. JACOBSON especially. See his memoir *Om Primordial-craniet* in *Förhandlingar vid de Skandinaviske Naturforskarnes tredje Möte.* Stockholm, 1842, pp. 739—744; compare also A. KOELLIKER in *Berichte von der Königlichen Zootomischen Anstalt zu Würzburg* (Leipzig, 1849), s. 35—42, where also are found anatomical notices on the labours of some writers who preceded JACOBSON on this point.

in the crocodiles abdominal ribs, which are nothing else than the ossified transverse tendinous strips of the straight muscles of the abdomen.

The vertebral column and the skull are the only essential parts of the internal skeleton. The limbs are wanting in most snakes and in some fishes, the ribs in the frogs and others. If now from the skeleton of a four-footed mammal or of man the limbs and the ribs be subtracted, then there will remain nothing but the vertebral column and the bony head.

The division of vertebrate animals into four classes, derived from LINNÆUS, has since his time been generally adopted and maintained, although some writers have wished to compose a fifth class from the scaleless Amphibia. That division is founded upon the temperature of the blood[1] and of the internal organs, upon the various forms of the heart, upon the difference of the respiratory organs, which are either gills or lungs, and upon the distinction of the parturition, the laying of eggs or the bringing forth of living young.

These four classes are those of fishes, reptiles, birds and mammals. Fishes and reptiles are cold-blooded, birds and mammals warm-blooded. Fishes breathe by gills, the remaining vertebrate animals by lungs; birds and mammals are thus warm-blooded animals that breathe by lungs; but of these the first are oviparous, the last viviparous.

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[1] If, during life, the temperature of animals undergoes only very little variation, and is almost entirely independent of that of the medium in which they live, then they are said to be warm-blooded. Animals whose temperature is dependent in great part on that of the air or of the water, in which they reside, are, on the other hand, named cold-blooded.

CLASS XIV.

FISHES (*PISCES*)[1].

THE Fishes are vertebrate cold-blooded animals, which live in water, and breathe by gills. Their external form is very various, yet in their internal structure there is still a correspondence sufficient for regarding the class of fishes as a natural division of the animal kingdom. LINNÆUS and BRISSON, at the beginning of the preceding century, separated from it the cetaceous animals, which, in the first edition of the *Systema Naturæ*, the great Swedish Naturalist had arranged with the fishes, although ARISTOTELES had already regarded the fishes and cetaceans as two large distinct genera or classes, adducing the gills as a special characteristic of fishes, which, moreover, as he sagaciously remarked, differ by the

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[1] On the class of fishes may be consulted amongst other works:

P. BELONII *De Aquatilibus Libri* II. Parisiis, 1553 (forma oblonga).

H. SALVIANI *Aquatilium Animalium Historia.* Romæ, 1553, folio.

G. RONDELETII *De Piscibus marinis.* Lugduni, 1554, folio.

G. WILLUGBEJI *Historia Piscium,* cura J. RAJI et C. MORTIMERI. Londini, 1743, folio.

P. ARTEDI *Ichthyologia, s. opera omnia de Piscibus posthuma,* edidit C. LINNÆUS. L. B. 1738, 8vo.

M. E. BLOCH *Œkonomische Naturgeschichte der Fische Deutschlands.* Berlin, 1782, 1784, III. Bd. 4to (with col. plates in folio).

M. E. BLOCH *Ichthyologie ou Histoire naturelle générale et particulière des Poissons.* Berlin, 1787—1797, XII. Vol. fol. (with 432 coloured plates).

BLOCH *Systema Ichthyologiæ,* edidit J. G. SCHNEIDER, 1801, 8vo, I Vol. (with 110, mostly coloured, plates).

LACEPÈDE *Hist. naturelle des Poissons.* Paris, 1798 to 1803, 4to, V. Vol. (also in small 8vo, XI. parts, with many figures).

CUVIER and VALENCIENNES *Histoire naturelle des Poissons.* Paris, 1828—1849, 22 Vols. (8vo or 4to) with 650 plates, coloured or uncoloured. The whole contains the *Acanthopterygii* and *Malacopterygii abdominales.* VALENCIENNES has undertaken a second series on the remaining *Malacopterygii* and the *Chondropterygii.*

On the anatomy of fishes, besides the work last cited, in which the internal structure of this class is illustrated by many figures from the river Perch, compare:

A. MONRO *The Structure and Physiology of Fishes explained and compared with those of Man and other Animals.* Edinburgh, 1785, fol.

R. OWEN *Lectures on the Comparative Anatomy and Physiology of the Vertebrate Animals.* Part I. *Fishes.* London, 1846, 8vo.

Special works on the fishes of particular countries and writings on different points of the anatomy of these animals will be cited now and then in the sequel.

absence of the glands that secrete milk, from the sucking dolphins and cetaceans. LINNÆUS, in the last edition of his arrangement, referred the cartilaginous and some other fishes, to which he erroneously ascribed, in addition to gills, lungs also, to the class of the *Amphibia*. This position was rejected by subsequent writers, and GMELIN, in the thirteenth edition of the *Systema Naturæ*, restored these animals to the fishes.

Fishes, as is well known, occur in water alone; and, however some or even many species from all the other classes of animals live in water, still fishes form the greatest number of the inhabitants of water, at least among vertebrate animals; so that it is not strange that, by the uninitiated and in common language, the appellation of fishes should be transferred to other water-animals.

Let us first consider shortly the external structure of fishes; this will afford us, at the same time, the opportunity of explaining some terms which are employed in the description of these animals.

The body of fishes may be divided into head, trunk, and tail. The head is an immediate continuation of the trunk; fishes have no proper neck, since the respiratory organs are seated under the head, and the thoracic cavity immediately succeeds to that of the mouth, or is even confluent with it. Hence the form of the body is very simple, usually attenuated gradually towards the two extremities. In some the hinder end is, as it were, cut off, as in the sun-fish (*Orthagoriscus*). In the rays the tail is much narrower than the trunk.

The body of most fishes is compressed laterally (*corpus compressum* s. *cathetoplateum*), so that the section is an oval, of which the back forms the broadest end. In others, as in the rays, it is depressed or flat (*corpus depressum* s. *plagioplateum*); in others, still, it is cylindrical, as in the eels; in others almost spherical, as in some species of the genus *Diodon;* in some, finally, angular, surrounded by flat or slightly concave surfaces, meeting in three or four projecting edges, as in the so-named Coffer-fishes, the genus *Ostracion*.

In general, the body is covered with scales (*corpus squamosum*). Sometimes the scales are small, and the smooth slimy skin seems to be naked, as in the eels; in some fishes, however, as in the cyclostomes, the scales are really wanting (*corpus nudum* s. *alepidotum*).

On each side of the body lies a row of apertures, sometimes extremities of bony tubes or of small pipes perforating the scales, and forms the so-called lateral line (*linea lateralis*); under this lateral line a glandular tissue, at least when these parts are more developed, has been observed. The slimy fluid, with which the body of fishes is covered, is secreted here. The line lies, in some cases, closer to the back, in others, more towards the abdominal side; it is in some fishes (as *Chromis*, *Xirichthys*) *interrupted*, i. e. behind it ceases on the back, and suddenly arises lower down, pursuing a new direction on the tail.

The head of fishes may, like the body, be narrow and compressed, or flat and broad, naked or scaly. In the frog-fish (*Lophius piscatorius*) it is almost as large as the body, in most fishes much smaller. The jaws are not always equally long. In some, as in *Xiphias*, the upper jaw, in others (especially in the genus *Hemiramphus*) the under jaw is extraordinarily elongated.

The aperture of the mouth in the sharks, rays and sturgeons is situated on the under side, in most fishes at the anterior extremity of the head. In the genus *Uranoscopus* the mouth is placed upwards. The lips and the jaws have often various appendages, filiform feelers (*tentacula*, *cirri*), &c.

The teeth are distinguished by their form and the different parts on which they are affixed. Besides the jaws, they may occur on the vomer, on the palate, the tongue, the branchial arches, and the small bones of the gullet.

The nasal apertures and the eyes are the only organs of sense that can be distinguished externally. In the genus of the soles (*Pleuronectes*) the two eyes are placed on the same side of the head. In others they lie one on each side, sometimes turned more towards the upper surface (as in *Uranoscopus*), rarely more downwards, as in the sucking-fish (*Echeneis*).

The gills have ordinarily on each side behind the head a single opening, through which the water, on expiration, is expelled (*apertura branchiarum*), and which mostly is in form of a semilunar fissure, convex backwards. They are protected by bony plates as a cover (*operculum*), of which the posterior margin is free. Beneath this is a membrane, which is folded and supported by bony rays that can expand it (*membrana branchiostega*). We shall advert to these parts more particularly in the sequel.

The fins are in part unpaired, situated in the plane that divides the body into two lateral halves, in part paired, lying on each side. The last may be four in number: two pectoral fins (*pinnæ pectorales*), which are placed higher and behind the gills, and two ventral fins (*pinnæ ventrales*), which are situated more below. In some fishes, as the haddock, these last are placed quite forward, in front of the pectoral fins (*pisces jugulares*); in others they lie almost directly below the pectoral fins (*pisces thoracici*); but usually they lie nearer to the tail, behind the pectoral fins, as in the carp (*pisces abdominales*).

The unpaired fin at the end of the tail is called the *caudal fin* (*pinna caudalis*), that which is attached to the body below, the *anal fin* (*pinna analis*), that which is situated above upon the back, the dorsal fin (*pinna dorsalis*). The dorsal and the caudal are sometimes divided, or several separate fins are placed behind each other. *Adipose fin* (*pinna adiposa*) is the name given to a small dorsal fin without rays, which lies behind the ordinary dorsal fin, as in the salmon.

The small bones which support the fins, and between which the skin of the fins is extended, are named *rays* (*radii*). These are either composed of joints and often split at the point into different filaments (*radii molles*), or simple, hard and pointed (*aculei* s. *radii spinosi*). When these last are present, they are situated at the fore part of the dorsal and anal fin. The number of rays is used as a specific character. Ordinarily the ventral fins are situated in front of the *anus*, whilst the anal fin begins behind it. In some fishes that have no ventral fins, the *anus* is placed far forward, close under the head (the genus *Sternarchus*).

This may suffice for the external form of fishes. We must now consider their internal structure a little more closely, and to that end shall first treat of their frame-work[1].

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[1] On the osteology of fishes, besides the general works on comparative anatomy by CUVIER, MECKEL, &c., the following may be consulted: BOJANUS *Versuch einer Deutung der Knochen im Kopfe der Fische* in OKEN'S *Isis*, 1818, I. s. 498—510; GEOFFROY SAINT-HILAIRE *Philosophie Anatomique*, I. Paris, 1818, 8vo; G. BAKKER *Osteographia piscium*. Groningæ, 1822, 8vo (with folio plates, in which the parts of the skeleton are principally illustrated in the haddock); L. AGASSIZ *Recherches sur les Poissons fossiles*. Neuchatel, 1833—1843, 4to, I. pp. 91—152 (*du Squelette des Poissons en general*); also in the work itself many osteological observations and descriptions of the skeleton of different genera are to be found, ex. gr. of *Esox* in the fifth part,

The chief constituents of bony tissue are, as is well known, phosphate of lime and gelatine. The organic constituent of the cartilaginous bones in sharks is, according to CHEVREUL, a peculiar animal matter, which, in its chemical properties, has more resemblance to mucus than to gelatine. According to MUELLER, the gelatine from the bones of osseous fishes does not jelly. The cartilaginous fishes have some parts of their skeleton which are more ossified, and contain much phosphate of lime, as the bodies of the vertebræ of sharks and rays, or they are coated with a hard ossified layer[1]. The difference therefore between cartilaginous and bony fishes is not very definite, since in these last moreover there is much cartilage remaining, especially in the skull.

We will now, first of all, confine ourselves to the form of the skeleton. It consists of the trunk, the head, the bony or cartilaginous apparatus of the respiratory organs and the fins. The spinal column consists of dorsal and caudal vertebræ; for, since fishes have no pelvis, there are no sacral nor lumbar vertebræ; as little are there cervical vertebræ, for the cavity of the thorax is situated under the head. Some writers indeed name those vertebræ that lie nearest to the head and to which no ribs are attached, cervical vertebræ; but since there are many fishes that have no ribs at all, no general use can be made of this distinction.

The notochord [OWEN] (*chorda dorsalis*) is persistent in some imperfectly organised fishes, and supplies the office of distinct bodies of vertebræ. It is deserving of remark that this embryonal state was very general in fishes of the earliest geological period, whence the explanation is given that, in the remains of the so-named Ganoïds no bodies of vertebræ are met with[2]. In most of the cartilaginous fishes, however, and in the bony fishes, bodies of

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pp. 60—68; OWEN *Lectures on the Comp. Anat. and Physiol. of the Vertebr. Anim.* Pt. I. *Fishes.* London, 1846, pp. 40—162. Here his theory of the cranial vertebræ is also fully propounded.

The richest collection of figures of the piscine skeleton is to be found in F. ROSENTHAL'S *Ichthyotomische Tafeln.* VI. Hefte. Berlin, 1812—1825. CUVIER, in the first part of his *Hist. natur. des Poissons,* has figured and described the skeleton of *Perca fluviatilis* in detail.

[1] *Abhandlungen der physikalisch-mathematischen klasse der Königl. Akademie der Wissensch. zu Berlin.* 1834, s. 136.

[2] AGASSIZ ascribed this previously to the accidental decomposition. *Recherches sur les Poissons fossiles,* II. I, pp. 83, 84.

vertebræ more or less ossified are present. These present in front and behind a conical cavity which is filled with a soft matter, the remains of the gelatinous cord. These two cavities often communicate in the middle of the body of the vertebræ by a small aperture between them, and thus have the form of an hour-glass placed horizontally. In *Lepidosteus* the remarkable exception occurs, that the bodies of the vertebræ exhibit a hemispherical surface at their anterior part, an articular head, and at the back part are concave[1].

Above the body of the vertebræ is situated a process on each side (*neurapophysis* OWEN). These processes are ossified earlier and more generally than the bodies of the vertebræ; they approach each other above, and thus form a ring above each of the vertebræ, the superior vertebral arch, in which the spinal marrow is lodged, and on which a spinous process is usually affixed. At the base of this superior vertebral arch there is generally situated forwards and backwards, sometimes forwards alone, a small articular process on each side, which serves, with the conical cavities of the bodies of the vertebræ, to connect the vertebræ; the anterior articular process overlaps the posterior process of the preceding vertebra, and is received in an excisure at the base of the superior vertebral arch. Sometimes, as in *Polypterus*, the superior arches of the bodies of the vertebræ remain distinct, but in most fishes they sooner or later coalesce with them. The dorsal vertebræ have transverse processes (*parapophyses* OWEN); the caudal vertebræ processes which bend downwards and approach each other to form in this way an inferior vertebral arch, within which the trunks of the blood-vessels are situated that run beneath the bodies of the caudal vertebræ. The number of vertebræ is very different in different fishes; in *Orthagoriscus mola*, for instance, there are only seventeen, in *Anarrhichas lupus* seventy-six, in *Muræna* more than an hundred. The tail is formed by nearly the half, and often by many more than the half, of these vertebræ. For the tail is in fishes the chief instrument of motion, and in most of them constitutes the greatest part of the body; all the organs are pushed forward to leave room behind for the large muscular mass which serves for motion.

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[1] AGASSIZ *Rech. sur les Poiss. fossiles*, II. 2, p. 23, Tab. β', figs. 10—12. A similar disposition is found in most of the *Reptilia*, but in them the articular head is behind.

In most fishes ribs (*pleurapophyses* OWEN) are present: each rib is attached to one vertebra alone, sometimes to its body, but ordinarily to the extremity of the transverse process. These ribs do not inclose the thoracic but the ventral cavity, and are not attached to a sternum below. Only in very few fishes, as in the herrings, the genus *Clupea*, is there a sternum present, which, as it consists of parts that belong to the dermal skeleton, might almost be called external: to it the extremities of the ribs are attached. Often, in addition to the ribs, there are little slender bones which are attached to the ribs or to the vertebræ and lie amongst the muscles. These fine spines are named the *ossicles of Artedi* (*spinæ epipleurales* OWEN).

The unpaired fins belong to the dermal skeleton and consequently have no relation to the morphological survey of the vertebræ. The caudal fin is usually attached to a triangular lamina which consists of the body of the last caudal vertebra and a connexion of the upper and lower spinous processes of some preceding vertebræ. The rays of the dorsal and anal fins are attached by means of a hinge-joint to small triangular flat bones, whose points are turned towards the vertebral column, and which may be named *interspinal ossicles*, since they lie between the spinous processes of the vertebræ. Sometimes interspinal ossicles occur to which no rays are attached. The first interspinal ossicle of the anal fin limits the ventral cavity behind, and often unites with the inferior spinous processes of the first caudal vertebræ to form a firm part in form of an arch[1].

The proper rays of the fins consist of two lateral parts, more or less coalesced; some are formed of joints and towards the extremity split into branches. This applies equally to the rays of the ventral and pectoral fins[2].

The pectoral fins are the anterior limbs of fishes, and correspond to our arms or to the wings of birds. They are attached to an osseous belt, which, in the bony fishes and sturgeons, descends from the skull, in the sharks and rays from the spinal column, and

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[1] In some species of *Chætodon* this bone is very thick, especially downwards. Here belongs that singular bone which OLAUS WORMIUS described, "*quod sua figura quasi murem repræsentat*," *Museum Wormianum*. Amstelodami, 1655, folio, p. 271. Compare the figure of the skeleton of *Ephippus gigas* CUV. in B. WOLF *Diss. inaug. med. de Osse peculiari Wormio dicto*. Berolini, 1821, 4to.

[2] Compare on the spines of the fins ROSENTHAL in REIL'S *Archiv f. die Physiol.* X. 1811, s. 359—372, with figs.

unites beneath with that of the opposite side. Each half of this belt, which in osseous fishes is situated behind the gill-cover, consists of two pieces at the least. The uppermost is usually regarded as a *scapula;* in most fishes it consists of two divisions, one placed below the other, of which the uppermost is situated like a scaly plate at the side of the head, and begins with two arms. The lower was by CUVIER compared with the upper arm-bone (*humerus*), but seems rather, as most writers conclude, to correspond to the clavicle (according to OWEN to the *coracoid clavicle*). Most anatomists are of opinion that the coracoid bone in the osseous fishes is represented by one or two bones, of which the lowest has the form of a pointed osseous style; this bone, or the uppermost when there are two, is attached to the upper extremity of the above-named osseous belt, and its lowest point, or the second bone, penetrates obliquely backwards and downwards amongst the muscles[1]. Downwards are attached to the posterior margin of the osseous belt two, seldom three, small bony laminæ. The two, which are usually present, may be regarded as the representatives of the bones of the fore-arm (*radius* and *ulna*); the third is probably a rudimentary upper arm-bone (*humerus*), which, however, as a rule, appears to be wanting in fishes.

To the outer extremity of the two bony plates, compared to the radius and ulna, a row of four or five cylindrical or doubly-conical small bones is attached corresponding to the *carpus*. To these no metacarpal bones are attached[2], but they sustain immediately the rays of the pectoral fins, which may thus be compared with fingers, but usually their number far exceeds that of the carpal bones.

The ventral fins are attached to a triangular bone with the point directed forwards, which meets that of the opposite side in the mid-line of the abdomen, the two being almost always connected by suture. This bone represents the pelvis. Besides this, the

[1] *Os epicoracoïdeum* of OWEN corresponding with the clavicle. Here OWEN recognises the homologue of an inferior vertebral arch (*hæmapophysis*) belonging to the first vertebra. *Lectures*, l. l. pp. 123, 160.

[2] In *Polypterus* alone there is a row of small bones, which may be compared with the *metacarpus*, inserted between the *carpus* and the fin-rays, as also in the posterior limbs between the pelvic bones and the rays of the fins there lies a row of four long opicles, which might be named *metatarsal* bones. Compare on the pectoral fins C. METTENHEIMER, *Disquisitiones de Membro Piscium pectorali*.

fingers alone of the posterior extremities are present, which correspond to the rays of the ventral fins.

The comparison of the skull-bones of fishes with those of the skull of the other vertebral animals, is a rock upon which the ingenuity of many naturalists has been wrecked. The skull of bony fishes consists of a much greater number of bones than that of man; and this peculiarity may in part be explained on the supposition that what in the embryo state of man and mammals are distinct points of ossification, in fishes persist as distinct bones during their entire life. Chiefly numerous are the bones which collectively represent the temporal bone in man[1]. On a superficial inspection the difficulty appears to be rendered still greater by the bones related to the largely developed tongue-bone and to the respiratory apparatus, which are connected with the bones of the skull. Moreover, some bones, which do not correspond to any in the skull of higher vertebrate animals, are to be referred to the dermal skeleton[2].

At the base of the skull three bones are readily distinguished, placed in front of one another in a row; the basal piece of the occipital bone, the body of the sphenoïd, an elongated bony lamina channelled above, and the vomer, which becomes broader and thicker forwards, and often on its under surface is armed with teeth. The basal piece of the occipital bone is a true body of a vertebra, and has behind a conical cavity for connexion with the first dorsal vertebra. Above it on each side lies a lateral occipital bone or articular portion (*occipitale laterale*, superior vertebral arch), which corresponds with the *condyloïd portion* of the human occipital bone. These bones approach one another above, but leave between them and the basal piece below an aperture nearly triangular (*foramen magnum*), through which the spinal marrow passes into the cavity of the cranium; they are perforated by a conspicuous aperture, through which the *nervus vagus*, and a smaller one through which the *n. glossopharyngeus*, leaves the skull. Above the occipital foramen is an unpaired bone, which sometimes forms a sharp crest in the

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[1] On this bone, and on the skull of vertebrate animals in general, much that is interesting is to be found in the celebrated work of E. HALLMANN *Die vergleichende Osteologie des Schläfenbeins*, mit 4 Kupfertafeln. Hannover, 1837, 4to.

[2] Without greater prolixity than this handbook permits we cannot offer more precise explanations of the names by which we describe the bones of the skull, and therefore must refrain also, for the most part, from criticising other designations of them.

middle, and corresponds to the squamous portion of the occipital bone (*crista occipitalis*). It often separates the two parietal bones above, whence it was named by CUVIER the *interparietal bone*. At the side of this bone and above the lateral occipitals on each side is a small bone, which is also usually referred to the occipital bone, the *os occipitale externum* of CUVIER. BOJANUS regarded this bone as the petrous bone, because one of the semicircular canals of the labyrinth is covered by it[1]. But this circumstance affords no sufficient ground for such a determination, since, on account of their great development, the semicircular canals of fishes may be protected by different bones. I rather suppose, with HALLMANN, that it is a part of the temporal bone[2]. Above the body of the sphenoïd bone and immediately in front of the lateral occipital bones, there lies a flat bone on each side, ordinarily very large, and presenting a foramen or notch, through which the second and third branch of the fifth pair of nerves pass. These bony plates are the large alæ of the sphenoïd (*os alisphænoïdeum* OWEN[3]). On the skull above lie the two parietal bones, which ordinarily are small. Only rarely do they meet in the middle of the head at the upper part in a sagittal suture, as in *Cyprinus*.

More in front, above the body of the sphenoïd (which with OWEN we regard as formed of the bodies of two vertebræ), are the two small wings of the sphenoïd (*orbito-sphænoïdea*), which follow upon the anterior margin of the large wings and mount up to the frontal bones. Under these wings through a membranous part the optic nerves proceed from the skull to the capsule of the eye. There are ordinarily two large frontal bones, distinguished by a median suture, which from the parietals and the occipital bone become narrower forward. Sometimes they are united to form a single bone, as in the haddock and the cod; in some a crest is found here in the midline, which is a continuation of the occipital crest[4]; sometimes they

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[1] BOJANUS *Anatome Testud. Europ.* p. 171.

[2] [OWEN, parapophysis of the epencephalic vert., corresponding to the jugular process of the human occipital bone.]

[3] MECKEL names this bone *os petrosum*, in which also HALLMANN and STANNIUS concur. On its inner surface, at the inferior margin, lies the sac of the membranous labyrinth.

[4] As in *Lampris guttatus*, *Zeus luna* GMELL., BAKKER l. l. p. 171, Tab. II. fig. III. *a*, in *Vomer*, &c.

are separated from each other by a membranous part (*fontanelle*), as in *Orthagoriscus*.

Under the small or anterior wings of the sphenoïd and the sphenoïd, there is situated in the perch and many other osseous fishes an unpaired bone, which divides above into two arms and rests upon the body of the sphenoïd below. CUVIER names this part anterior sphenoïd (*rostrum ossis sphænoïdei*, *sphenoïde antérieur*). More justly, as AGASSIZ determines, may it be regarded as the æthmoïd bone; in many fishes it remains cartilaginous. Above it joins the anterior and the large wings of the sphenoïd [1]. In front of this and below the anterior portion of the frontal bones lies the nasal bone, a single bone, which is commonly described as the æthmoïd (by BOJANUS as the *crista æthmoïdalis*). On each side of this are situated the so-named anterior frontal bones (*frontalia anteriora*), which are small and closely connected with the nasal bone.

An interposed bone (*os intercalare*) may be observed on each side of the skull under the parietals and the external occipitals, which was named mastoïd (*os mastoïdeum*) by CUVIER. Often it is produced into a point at the back part of the skull. It may be compared to the squamous portion of the temporal bone, since the external occipital is rather to be regarded (p. 19) as the mastoïd [2]. In this bone there is often on the inferior part a small bony piece, which is attached to the lateral occipital bone. It is present in the perch, for instance, but is absent in the pike. CUVIER supposes it to correspond with the petrous bone, which we think is not present in osseous fishes [3]; it is an accessory of the squamous portion of the temporal. Other parts of the temporal bone, which relate to the articulation of the lower jaw, belong to the bones of the face.

The cranium is connected with the lower jaw on each side by a belt of different bones, which collectively make up the articular portion of the temporal bone. In the sharks and rays there is only a single cartilage on each side (*suspensorium*), which corresponds with the quadrate bone (*os quadratum* s. *tympanicum*) of birds and

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[1] [OWEN names this bone *entosphenoïd*, as the common base of the two orbito-sphænoïds: it is peculiar, as a distinct bone, to fishes. See *Homologies*, p. 44.]

[2] [According to OWEN the squamosal is normally absent in fishes. *Homol.* p. 62 With OWEN as well as CUVIER the bone in question is the mastoïd.]

[3] [See OWEN *Homologies*, p. 28. The petrosal is the capsule of the labyrinth, and is never entirely ossified in fishes; if so, it belongs to the splanchno-skeleton.]

reptiles. In the osseous fishes there are four or five bones on each side, of which the uppermost (*epitympanicum* OWEN) is connected with the skull (with the squamosal [*mastoïd* OWEN] and posterior frontal) by articulation, whilst at the upper part behind it has an articular surface for the gill-cover (*operculum*). Under this bone is a flat osseous disc, often of a circular form; to this CUVIER gives the name of *os tympanicum;* behind it lies a styliform bone[1], and under the two a triangular bony lamina with a smaller inferior extremity and an articular head, which is connected with the lower jaw. CUVIER names this the jugal bone. (In the batrachians the jugal bone runs from the upper jaw to the quadrate bone, and then forms a portion of the articular head for connexion with the lower jaw.) Behind this connecting arch there lies between the skull and the lower jaw the gill-cover, consisting of various bones, of which the first descends as an elongated curved bone nearly as far as the lower jaw. This *præoperculum* seems to be simply a portion of the temporal bone, according to GEOFFROY SAINT-HILAIRE the proper *os tympanicum*, according to AGASSIZ the styliform process (*processus styloïdeus*[2]).

The upper jaw-bones are commonly without teeth, and lie in the upper lip; they run obliquely backwards and downwards, without being connected at the extremity with other bones. The intermaxillary bones are, on the other hand, usually armed with teeth; as are also the palate-bones, which are situated at the sides of the vomer. Behind each of these palate-bones lie two bones which are attached by cartilage to the jugal bone and the lamelliform middle portion of the quadrate bone, and may be aptly compared with the pterygoid processes that divide into an external and internal wing[3].

Below the orbits of the eye is placed a row of bony scales, quite external, which form a half-ring connected behind with the anterior frontal bone. Some writers regard these bones as parts of the jugal bone; but they belong perhaps to the dermal skeleton, and thus may be compared with the apparatus of the lateral line

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[1] *Os symplecticum* CUVIER, *Tympano-malleale* AGASSIZ, *Meso-tympanicum* OWEN.

[2] [OWEN *Homologies*, p. 65. The opercular bones have no special homologues in higher animals. They form collectively the diverging appendage of the descending or tympano-mandibular arch of the third cranial vertebra.]

[3] [OWEN *Homologies*, p. 114. The diverging appendage of the maxillary arch of the fourth, or anterior, vertebra of the head.]

(*linea lateralis*) for secreting mucus, as its continuation on to the head[1]. The anterior of these *sub-orbital bones*, which is also the largest, forms the outer or inferior margin of the nasal cavity. The superior margin of the sac of the olfactory organ is formed by a small plate of bone (the nasal bone according to CUVIER), which also appears to belong to the dermal skeleton, and runs on each side of the anterior frontal bone to the bone of the upper jaw. It is the turbinated bone according to OWEN.

The under jaw is divided into a right and left portion; these two halves are united in the middle by cartilage and ligamentous tissue alone. Each half usually consists of three pieces; an articular piece on each side (*os articulare*), beneath it a small bony piece for the angle of the lower jaw (*os angulare*), and an anterior piece, in which the teeth are fixed (the *dental piece, os dentale*), in the posterior margin of which is a triangular excisure for the reception of the articular piece.

We must next consider the tongue-bone, which presents a large development in the class of fishes, from its connexion with the gills, as an osseous respiratory apparatus. The body of the lingual bone lies under the head in the mid-plane, and usually consists of a series of unpaired bony pieces placed behind one another; forward, a cartilaginous or bony lamina penetrates into the tongue (*glossohyale* GEOFFROY SAINT-HILAIRE). To these bony pieces five arches are attached, like ribs to a sternum. The hindmost arc is incomplete, and is simply laid on the under side of the gullet; it consists on each side of a bone, which, on its upper surface, almost always bears teeth (the so-named *ossa pharyngealia inferiora*). In some fishes (*Scarus, Labrus*) the two unite to form a single unpaired bone. The four anterior arches consist of several bony pieces, of which the uppermost mount up beneath the skull and bear teeth on their inferior surface (*ossa pharyngealia superiora*); the two middlemost, which are grooved beneath, bear the branchial laminæ. At the side, and in front of the first branchial arch, two small bones are situated on each side, to which the horns of the tongue-bone are

[1] Compare STANNIUS *Ueber die Knochen des Seitenkanals der Fische*, FRORIEP'S *Neue Notizen*, Bd. XXIII. s. 97—100 (April, 1842). Of the same kind are certain bony plates, which in many fishes are situated laterally near the parietal bones, the *ossa supra-temporalia* of BAKKER and CUVIER.

affixed, consisting of two flat bony pieces, that mount beneath the lower jaw, and are connected by means of a small styliform bone to the inner surface of the uppermost bone of the mandibular arch (*epitympanicum*), which connects the lower jaw to the cranium. A laterally compressed unpaired bone runs backwards from the union of the two horns of the tongue-bone, and is usually connected to the belt of the clavicles which sustains the pectoral fins. Beneath the horns of the tongue-bone is the so-named branchiostegous membrane (see above, p. 12), which completes the branchial aperture; this membrane is supported by long ossicles bent backwards, called rays of the branchiostegous membrane, of which the number varies in different fishes, by which the generic characters may be compared; many fishes have seven such rays, the *Cyprini* only three, where however they are broader.

The three bony plates situated behind the *præoperculum* may be regarded as radiations from that bone corresponding to the branchiostegous rays from the horns of the tongue-bone. These plates form the gill-cover, the most external part of the bony apparatus for respiration. The largest of these pieces (*operculum* Cuv.) is a lamina attached to the *epitympanicum*, and forms the upper and outer edge of the branchial aperture. It has an irregular, more or less triangular, form; beneath it lies another small bony plate (*subperculum* Cuv.), and a smaller is placed in front of this below the *præoperculum* (*interoperculum* Cuv.). In the sharks, divided, cartilaginous radiations, like fingers, at the posterior margin of the *os tympanicum*, are met with, corresponding with the gill-cover; below they are repeated by similar appendages of the tongue-bone, which represent the branchiostegous rays. The sturgeons have no branchiostegous rays, but they have gill-covers like other fishes[1].

After this concise description of the skeleton, which in vertebrate animals must form the commencement of all anatomical survey, we may proceed to treat of the remaining internal parts of fishes.

The teeth, whose insertion upon various bones we have already indicated above, usually serve rather for seizing the prey and holding

[1] This subject is excellently treated by H. Rathke in *Anatomisch-philosophische Untersuchungen über den Kiemenapparat und das Zungenbein der Wirbelthiere.* Riga u. Dorpat, 1832, 4to.

it fast, than for dividing it. In form and number they present much variety in this class. In some fishes, as in the genus *Acipenser*, *Syngnathus*, &c. the teeth are entirely absent; in others, as the pike, they exist in great numbers in the lower jaw, the intermaxillary bone, the vomer, the palate-bones, the tongue, the branchial arches and the pharyngeal bones. Teeth are rarely met with in the two upper jaw-bones that lie in the lip. The form is very various, sometimes that of laminæ, mostly that of a cone, much like the corner teeth of mammals. Sometimes the teeth are as fine as hairs, as in the genus *Chætodon*. The mode of attachment differs, yet only seldom are they contained in sockets; ordinarily they are united to the bones by ligamentous matter alone or are coalescent with them by ossification. They are usually renewed constantly, and a regular replacement of teeth that occurs only once is met with in the mammals alone[1].

Salivary glands are not met with in the class of fishes. As a rule, these organs are more largely developed in animals that live on vegetable food than in those that make use of animal food; fishes live mostly on the last. Saliva also may more easily be dispensed with where no mastication is performed, and the food, as in fishes, is rapidly swallowed. There are, however, as in the sharks and rays, under the palate acinous glands, which secrete a slimy fluid; but these cannot be regarded as homologous with salivary glands. As little is there any excretory duct to the structure which in the carp is situated under the skull, in front of the *ossa pharyngealia*, which by some has been looked on as a salivary gland[2], and of which the strong contraction under the action of various irritants has been announced by WEBER and MUELLER[3].

The tongue in most fishes is small, and possesses slight mobility. The œsophagus commences like a funnel in the wide cavity

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[1] For obtaining a well-grounded knowledge of the teeth of fishes, the accurate and comprehensive work of R. OWEN, *Odontography*, London, 1840—1845, 8vo, pp. 1—178, must be referred to.

[2] H. RATHKE *Beiträge zur Geschichte der Thierwelt*, II. Halle, 1824, 4to, s. 1—7. Such a spongy tissue RATHKE found not only in *Cyprinus*, but also in *Cobitis*, *Silurus*, *Belone*, &c. (very small in the last-named genus); he is of opinion that it occurs universally in those (osseous) fishes that have no *appendices pyloricæ*.

[3] E. H. WEBER, in MUELLER'S *Archiv für Anat. u. Physiol.* 1827, s. 308—311, regards it as an organ of taste. MUELLER found in it animal muscular fibre. *Physiol.* II. 35.

of the mouth, is usually very short, and furnished internally with longitudinal folds. It is often difficult to distinguish the stomach from the œsophagus, which directly passes into it; and to assign precisely the limit of the two. In some, as in the genus *Cyprinus* and in *Cobitis fossilis*, there is no distinction.

The gullet (*pharynx*) is constantly surrounded by a layer of circular fibres, a true sphincter muscle, behind the *ossa pharyngealia*.

In some fishes, as the pike, the stomach has an elongated form, wider in the middle, and the pylorus is situated at the posterior extremity, opposite to the superior orifice. In others the stomach is reflected at an angle or arch, the cardiac portion (*pars cardiaca*) being divided from the pyloric by a constriction, and the latter towards its extremity where it passes into the intestine is sensibly narrower, whilst the former preserves nearly the same width throughout. Such, for example, is the form of the stomach in *Cyclopterus lumpus*. The most usual form however of the fish's stomach is that where the cardiac portion is prolonged into a blind sac below, whilst the pyloric portion lies transversely above this last on the right side of the stomach, like a narrower portion of intestine; such a stomach is found for instance in *Lophius piscatorius*, *Sciœna aquila*, &c., and, amongst our fresh-water fishes, in the perch. The muscular membrane of the stomach is always thinner than that at the commencement of the œsophagus, and consists of longitudinal and circular fibres.

With very few exceptions there exists at the pylorus an annular fold or membranous valve, which indicates the commencement of the small intestine. The distinction between the small and the large intestine is not always very obvious; the circumference of the posterior part of the intestine is not always larger, sometimes even smaller than that of the so-called small intestine. Almost never is there to be found a trace of a cœcum at the commencement of the large intestine, but often (at least in the osseous fishes) an annular membranous valve, like that of the pylorus, is met with at the termination of the small intestine. The intestinal canal is of very various length, more or less convoluted; on the whole, however, it is short. In *Petromyzon*, *Syngnathus*, *Belone*, and some others, it holds an entirely straight course, without any flexure from the mouth to the vent. In the sharks and rays also the canal is short, but here a membranous valve of a spiral form, present also in the sturgeons

and *Polypterus*[1], enlarges the absorbent surface and delays the passage of the food. In the sturgeons this spiral valve extends to the anus. Usually it is turned obliquely, like a staircase, but in *Zygæna*, and some other sharks, it is attached lengthwise to one side, and is convoluted on itself, so that, when unrolled, it appears like a broad lamina[2].

The internal surface of the mucous membrane of the intestinal canal usually presents longitudinal projecting lines or folds, which often have a sinuous edge, or are incised transversely, or are united like a net, as in *Lophius piscatorius*. Only in very few fishes do true *villi* occur, like those commonly met with in the small intestine of the higher vertebrates.

The position of the anus is very various. When fishes have a ventral fin it lies behind this, more or less remote from it. In the *jugular* fishes (p. 13), and such as have no ventral fins (*apodes*), the vent is situated below the gullet, and the intestine towards its termination bends directly forwards, as for instance in the genus *Sternarchus*. In some *Pleuronectes* (*Solea*) a part of the intestinal canal lies external to the abdominal cavity, or rather the abdominal cavity, with its lining of peritoneum, is prolonged behind the first interspinal bone of the *pinna analis*, which constitutes the osseous boundary between the ventral cavity and the tail[3]. The peritoneum has, in the *Plagiostomes* and some osseous fishes, two apertures near the *anus* which conduct outwards (*pori abdominales*), by which in these last-mentioned the eggs and the sperma are discharged; the internal sexual organs lie with the intestinal canal in the sac of the peritoneum. External to and behind, or rather above, the peritoneum lie the kidneys and the swimming bladder upon

[1] In the so-named *Ganoids*. See a figure of the intestinal canal of *Polypterus bichir* in J. MUELLER'S notice of this fish, *Abhandl. der Konigl. Akad. der Wissensch. zu Berlin, Physik. Klasse*, 1844, Tab. VI. fig. 1. In *Lepidosteus* also MUELLER observed an indication of the valve in the intestinal canal at the lower part; ibid. p. 91.

[2] MECKEL'S *System der veryl. Anat.* IV. 1829, s. 35, in *Zygæna*; in *Galeus Thalassinus* (*Thalassorhinus vulpecula*), and *Glaucus*, DUVERNOY *Ann. des Sc. nat.* sec. Série, III. 1835, pp. 274—284, and STEENSTRA TOUSSAINT *Tijdschr. voor nat. Geschied. er Physiologie*, X. 1843, pp. 103—107, Pl. 3. (According to MUELLER and HENLE this arrangement occurs commonly in *Zygæna*, *Carcharias*, *Galeocerdo* and *Thalassorhinus*.)

[3] Numerous figures of the stomach and intestinal canal, in different fishes, are to found, amongst others, in HOME'S *Lectures on comp. Anat.* II. Tab. 85—97, and especially in RATHKE *Beiträge zur Gesch. der Thierwelt*, II. Tab. I—IV., and in his memoir on the intestinal canal of fishes in MUELLER'S *Archiv*, 1837, s. 335—356, Taf. 17—19.

the spinal column. The productions of peritoneum by which it is connected with the lamina that surrounds the intestine, are mostly filaments or narrow bands remote from each other, and only rarely form a mesentery. In these productions, and also in the free folds of peritoneum, which may be compared with the *omentum*, there often lies a larger or smaller quantity of very white and soft fat.

The blind appendages (*cæca*, *appendices pyloricæ*) deserve a special notice, which are attached to the intestinal canal in the neighbourhood of the pylorus, and in which a tenacious, slimy fluid is secreted. They are wanting in the *Plagiostomes* and *Cyclostomes*, in the *Plectognathi* and *Lophobranchii*, as also in some common bony fishes, as in the pike and in the carps (the genus *Cyprinus* L.). When present they differ much in form, size, and number. *Polypterus* and *Ammodytes tobianus* have only one such appendage, *Lophius piscatorius* has two, the perch three, in *Trigla* five or more are counted, nine or ten in *Sciæna aquila*, and they are still more numerous in the genus *Gadus*, in the herrings and salmons. When they are numerous they sometimes unite at their insertion in the intestinal canal to form common ducts, so that there are fewer openings into the intestine than blind appendages. Sometimes they are collected into bundles and connected by cellular tissue, as in *Xiphias gladius*[1], and in the sturgeons, where they form a gland-like body with a single efferent duct[2]. Accordingly these appendages have been usually regarded as supplying the office of a pancreas, which in the sharks and rays presents itself in the ordinary form. In the pike the *pancreas*, as a long whitish-yellow gland, lies along the left side of the stomach, connected with the liver by many short vessels, and covered by it. In the pike the *pancreas*, as a longitudinal whitish-yellow gland, lies along the left side of the stomach, connected with the liver by many short vessels, and covered by it. Also in the eel, *Muræna anguilla*, a pancreas is found, which, as an elongated reddish-white mass terminating in a point backwards, lies upon the intestinal canal, and delivers its

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[1] ROSENTHAL *Abhandlungen aus dem Gebiete der Anatomie, Physiol. und Pathologie.* Berlin, 1824, 8vo, s. 79. The branches of these bundles unite here to form two stems, which are inserted close to the *pylorus*.

[2] *Observationes anatomicæ Collegii privati Amstelodamensis.* Amstelodami, 1673, 12mo, pp. 17—24, Tab. III.; MONRO *Struct. and Physiol. of Fishes.* Edinb. 1785, fol. Pl. IX.

secretion by two ducts close to the duct of the gall-bladder[1]. In *Cyprinus* E. H. WEBER had found a duct close to the *ductus choledochus*, opening into the intestine, and dividing into branches in the liver, but containing no bile[2]. Since however in the investigation of fishes that have *appendices pyloricæ* a distinct pancreas has lately been discovered in addition[3], it would seem that the opinion which assigns to these appendages the place of this gland can no longer be maintained; probably, however, they also secrete a fluid that assists in the conversion of the food; for that they merely supply the intestine with a larger surface for absorption, at least where they are closely collected into bundles or divided into branches, is not easily to be imagined[4]. In *Lepidosiren* the *appendices pyloricæ* and the *pancreas* are wanting.

Fishes have a large, soft liver, saturated, as it were, with oily fluid. It often extends far backward in the abdominal cavity, and sometimes fills the spaces between the convolutions of the intestinal canal, as in the molluscs. In many fishes it lies more to the left than the right side. Its form is very various; when it is divided into lobes the number of these is very different, mostly, however, two, which are united by a small strip. In *Myxine* the liver consists of two portions quite distinct from each other. The gall-bladder is absent in very few species only of fishes; commonly it is large. Its duct, or the gall-bladder itself, receives the hepatic duct from the liver and penetrates the intestinal canal mostly close to the pylorus. The venous blood of the intestines is carried by three or two trunks, or by a single larger trunk, and usually by smaller branches in addition, to the liver. The venous blood from the swimming bladder, and in some fishes that also which returns from the organs of propagation, also flows to the liver before returning to the heart[5].

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[1] *Observat. anat. Coll. privat. Amstel.* II. p. 35, Tab. VIII. fig. 1; F. G. MIERENDORFF *De Hepate piscium.* Berolini, 1817, 8vo, p. 50, fig. 2.

[2] MECKEL'S *Archiv f. Anat. u. Physiol.* 1827, s. 294—299, Tab. IV. fig. 22.

[3] In *Acipenser Sturio* by ALESSANDRINI, *Ann. des Sc. nat.* Tom. xxix. 1833, pp. 193, 194, and lately by STANNIUS, in many fishes of different families. MUELLER'S *Archiv*, 1848, s. 405—407.

[4] Very rarely, if ever, has chyme been found in the appendages.

[5] Compare on the liver of fishes, besides the work of MIERENDORFF cited above, H. RATHKE in MECKEL'S *Archiv f. Anat. u. Physiol.* 1826, s. 126—152, and in MUELLER'S *Archiv*, 1837, s. 468—475.

The spleen is absent in the *Cyclostomes* and *Lepidosiren* alone. It is of a blood-red colour, lies mostly on the right side, close to the stomach or the anterior portion of the intestine, and has sometimes one or more parts distinct from it (accessory spleens). In the perch it is placed as a narrow, elongated mass, within the first convolution of the intestine; in the pike it lies behind the stomach, which it surrounds like a hood. In *Squatina* two spleens occur, a smaller, elongate and oval, in the neighbourhood of the *pancreas*, and another circular, placed on the stomach at its lower part. In *Lamna* and *Carcharias* there are several spleens distinct from each other.

The lymph-vessels of fishes were first described by HEWSON and A. MONRO (in 1769 and 1770). According to the researches of FOHMANN, who, some years ago, described and figured them more completely, they consist of a simple membrane, resembling serous membrane, and very smooth on the inside. They have no valves, except where the larger stems empty themselves into the veins. These larger stems fall into veins which may be compared to the subclavian veins. In addition there are still other communications between smaller lymph-vessels and venous branches. The chyle, at least in the rays, is of a grey colour. Neither in the mesentery nor elsewhere are conglomerate or lymphatic glands met with in fishes[1].

The venous trunks, which return the blood from the different organs, conduct it to a large venous sinus situated between the pericardium and the membrane which supplies the office of diaphragm, and is properly nothing but the anterior part of the peritoneum strengthened by some tendinous filaments. The auricle, on the other hand, lies in the pericardium with the ventricle, and is ordinarily broader than it. At the opening of the auricle into the ventricle valves are situated which prevent the reflux of the blood.

The heart of fishes is small, and its weight forms ordinarily only $\frac{1}{400}$, sometimes only $\frac{1}{1000}$ part of the weight of the whole body. It is situated behind and between the gills, in osseous fishes under the head, above the junction of the two clavicles (see above, p. 17). The muscular substance of the heart is of a red colour, although the voluntary muscles, as is well-known, are pale or even white.

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[1] FOHMANN, *Das Saugadersystem der Wirbelthiere*, Heft I. Heidelberg u. Leipzig, 1827, fol.

In the osseous fishes the heart is more elongated, conical, in the rays and sharks broad. Its walls are very thick, and the muscular fibres are arranged in two layers, which sometimes separate from each other after death. Commonly not more than 20 or 30 beats of the heart are counted in fishes in a minute, whilst in birds 100 and more occur in the same period. The irritability of the heart continues long after death; it beats, too, often for hours after it has been removed from the body.

From the anterior part of the heart arises a single arterial stem. In the osseous fishes it commences with a conical thickening (*bulbus*); in the *Cyclostomes* this thickening is absent. At the origin of this arterial stem are semilunar valves, commonly two in number, which prevent the return of the blood into the ventricle after its contraction. In the sturgeons, the *Plagiostomes*, and, according to the investigations of MUELLER, in *Polypterus* and *Lepidosteus* also, the muscular substance of the heart is prolonged into a cylindrical part before the origin of the arterial stem, and in that cylindrical appendage (a true elongation of the ventricle) are many valves arranged in three or more longitudinal rows[1].

The continuation of the arterial stem now comes to view from the pericardium, and distributes itself as branchial arteries to the respiratory organs. The heart of fishes is thus venous alone, and in a physiological point of view is to be compared to the right ventricle of the human heart, whilst the arterial stem, conducting the venous blood to the gills, agrees in function with the pulmonary artery. But it does not follow from this that the heart of fishes corresponds also, in the view of comparative anatomy, to the right ventricle of birds and mammals. The metamorphoses of frogs and salamanders, and the development of the embryo of the higher matter, must here afford the illustration. This comparison teaches us, that from the heart, originally still undivided, there arise on each side different arterial arches, and that the pulmonary arteries are at first only branches of the hindmost of these arches.

Thus in fishes the branchial arteries are to be compared to the arterial arches of the embryonal state. But, instead of immediately bending round to form the aorta, they separate into branches and

[1] The work of F. TIEDEMANN, *Anatomie des Fischherzens*, mit 4 Kupfert. Landshut, 1809, 4to, contains many details on the heart of this class.

a fine network of capillaries on the gills. From this the roots of the branchial veins arise, which mounting along the branchial arches, afterwards unite to form the large artery. Hence in fishes a system of capillaries is placed between the heart and the *aorta;* and this is one of the most characteristic peculiarities in the anatomy of this class.

Already from the branchial veins, before they unite to form the *aorta*, certain arteries arise especially for the head. In the bony fishes the branchial veins of each side first unite to form a vein (*vena branchialis communis*), and pass backwards into the *aorta*, whilst, according to the discovery of HYRTL, they are united in front by a transverse vessel, and thus form an arterial circle (*circulus cephalicus*) beneath the cranium[1]. The arteries (*arteriæ axillares*) for the anterior limbs (pectoral fins) are, in *Torpedo* and *Chimæra*, provided with a muscular covering and expanded into lateral hearts[2]. In *Amphioxus lanceolatus*, where the heart is not enclosed in a pericardium and is tubular, contractile swellings have also been observed on the branchial arteries, and, moreover, on each side a pulsating arch, which passes immediately from the heart to the *aorta*[3].

The venous system also of fishes may be illustrated by the history of development in higher vertebrate animals. This teaches us that originally there are two anterior and two posterior venous stems which conduct the blood back to the heart. The anterior are the persistent *venæ jugulares;* the posterior, which, at a later period, when the cava is developed, in great part disappear, are named by RATHKE *venæ cardinales*. On each side the anterior and posterior venous stems meet in a transverse canal (*Ductus Cuvieri*), which

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[1] Similar in form to the arterial *circulus Willisii* within the human skull.—The work of HYRTL on the vascular arrangement of fishes (*Medic. Jahrb. der Œstterr. Staates.* Neueste Folge, Bd. XV. 1838) is known to me, and perhaps to many others, from citations alone. Compare also on this subject, J. MUELLER in *Abhandl. der Königl. Akad. der Wissensch. zu Berlin, aus d. J.* 1839, *Vergl. Anatomie der Myxinoiden, dritte Fortsetzung.* This entire work is published separately, Berlin, 1835 and 1841.

[2] According to J. DAVY in *Torpedo, Phil. Trans.* 1832, p. 259; according to the investigations of DUVERNOY, and afterwards of VALENTIN in *Chimæra, Ann. des Sc. natur.*, sec. Série, VIII. 1837, pp. 35—41, MUELLER'S *Archiv*, 1842, s. 25.

[3] Here also the portal vein and the cava are pulsating tubular hearts. See MUELLER *Ueber den Bau und die Lebenserscheinungen der Branchiostoma lubricum. Abh. der Königl. Akad. der Wissenschaft. zu Berlin aus d. Jahre* 1844.

unites with that of the opposite side, and thus conducts the blood to the auricle of the heart. What, therefore, is thus seen in the embryonal state of other vertebrate animals remains in fishes as the permanent form. There are properly no posterior cavæ, which in fishes are usually so named, but venous stems which correspond to the *venæ cardinales* of the *embryo*, and of which in osseous fishes that of the right side is usually much the most developed, so that a single posterior cava alone is ascribed to them. The venous stem, or the veins that come from the liver (*vena hepatica* or *venæ hepaticæ*), join the common venous sinus into which the two *ductus Cuvieri* open. The hepatic veins alone are those that can be compared with the posterior cava[1].

In *Anguilla* and *Muræenophis* the veins of the caudal fin unite to form a pulsating venous heart on each side of the last caudal vertebra[2]. In *Myxine* the portal vein is distended into a large sac, which contracts and expands alternately[3]. In fishes, as in other classes of animals, arterial and venous plexuses (*retia mirabilia*[4]) occur, in which the stem is suddenly lost as it were, and of which the vessels at first lie side by side without dividing into branches, but afterwards either pass into capillaries or unite to form one or more larger trunks. They occur in the vessels of the viscera in *Thynnus* and some sharks, also in the swimming bladder of

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[1] H. RATHKE, *Ueber den Bau und die Entwickelung des Venensystems der Wirbelthiere; dritter Bericht über das Naturwissensch. Seminar zu Königsberg.* 1838, 4to.

[2] According to the discovery of MARSHALL HALL in the eel; according to MUELLER, in *Muræenophis* also. At the same part many osseous fishes have a *sinus*, which belongs to the lymphatic system of vessels. See HYRTL in MUELLER'S *Archiv*, 1843. s. 224—240, with fig.

[3] MUELLER'S *Archiv*, 1842, s. 477.

[4] In *Thynnus vulgaris* and *Thynnus brachypterus* the veins from the stomach, the intestinal canal and the spleen, before entering the liver, form very large *retia mirabilia* of pencil-shaped branches, from which subsequently larger veins arise as portal branches; the artery that goes to the abdominal viscera (*arteria cœliaca*) distributes its blood by such nets alone to the stomach and the intestinal canal, but to the liver by an hepatic artery not deviating from the ordinary form. D. F. ESCHRICHT u. J. MUELLER *Ueber die arteriösen und venösen Wundernetze an der Leber des Thunfisches* (*Abh. der Akad. der Wissensch. zu Berlin*, 1835). In *Lamna cornubica* such arterial and venous networks are met with, here formed by the hepatic veins; in *Carcharias vulpes* there are venous and arterial *retia m.* of a pennate form on the stomach and that part of the intestinal canal where the spiral valve is situated: see A. BARTH *Diss. inaug. de Retibus mirabilibus*, Berolini, 1837, 4to, after observations of J. MUELLER.

many fishes; the red, apparently glandular body, that in most bony fishes surrounds the entrance of the optic nerve into the ball of the eye at the choroïd coat (*glandula choroïdalis*), is merely such a vascular network.

The respiratory organs of fishes, the gills, consist in most of small leaflets usually triangular and of equal breadth, attached by their bases to the branchial arches on which the branchial arteries ramify. These leaflets mostly form two rows on each branchial arch; if one such row alone be present, then the name of half-gill is given to such an arch. In the bony fishes and the sturgeons the branchial arches are on the outside free; the water is taken in by the mouth and afterwards expelled by two gill-apertures behind the gill-covers (one on each side). In the sharks and rays, on the contrary, there proceeds from each branchial arch, between the branchial leaflets of the anterior and posterior row, a membranous production as far as the skin, entirely covering the gills in these fishes, excepting five apertures for the expulsion of the water; hence arise complete partitions between the pharynx and the skin, in which the branchial arches are situated. The posterior wall of the fifth gill-cavity is here without branchial leaflets. The leaflets are cartilaginous internally, or rarely bony, and are covered with a rich vascular net, so as to have a bright red colour[1]. The entire apparatus is covered by a continuation of the mucous membrane of the mouth. In the respiration of fishes the air contained in the water is alone effectual, and by no means the oxygen of the water, which is not decomposed by this function. Some fishes mount to the surface of the water to breathe atmospheric air itself, and they die when this is rendered impossible by gauze interposed. But fishes cannot live long out of water; some die even very rapidly, because the leaflets fall together and cohere, so that the circulation of blood in these organs is interrupted, and the oxygen of the air cannot act upon the parts that thus cover each other[2].

With the half-gills or the accessory gills, which in the sturgeons occur on the gill-cover, those false gills (*pseudo-branchiæ*)

[1] DOELLINGER gave a very beautiful figure of this vascular net in *Abhandl. der mathem. physik. Klasse der Akad. zu München*, II. 1837. *Ueber die Vertheilung des Blutes in den Kiemen der Fische*, s. 785—794, Tab. I. fig. 3.

[2] See FLOURENS *Experiences sur le mécanisme de la respiration des Poissons*, *Ann. des Sc. natur.* XX. 1830, pp. 5—25.

must not be confounded which in many fishes are found on the palate, above and outwards from the gills, sometimes presenting a more glandular lobulated structure, but mostly a pennate or pectinate form with a single row of leaflets. Since these organs receive arterial blood, they cannot be for respiration. The blood that returns from them unites with that of an arterial branch (*arteria ophthalmica magna*) which supplies the choroïd coat of the eye-ball, where usually it forms a *rete mirabile*, which, connected with a similar venous net for the blood returning from the eye-ball, forms the choroïd gland lately spoken of, and which usually occurs simultaneously with the false gill[1].

As little as this organ does the swimming-bladder of fishes deserve to be regarded as serving for respiration[2]. This bladder occurs in the sturgeons and many osseous fishes, and is situated above the intestinal canal towards the spine, but under the kidneys, almost always as an unpaired symmetrical organ. Its walls are formed by two membranes; an external tendinous membrane and an internal thin mucous membrane, richly supplied with vessels and covered with flat *epithelium* on the inner surface. In addition, this bladder is invested on the ventral surface with a production from the peritoneum. In some fishes a duct proceeds from it to the œsophagus or to the stomach; in some there is a fissure, as a species of *glottis*, which leads immediately from the œsophagus to the swimming-bladder. Since the swimming-bladder comes into being as an eversion of the intestinal canal, it is probable that even in cases where it is quite closed a canal existed at an earlier period, which has been condensed to form a ligament, or has been entirely absorbed. In many fishes, in most sea-fishes especially, the swimming-

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[1] Compare J. MUELLER *Abhandl. der Akad. der Wissensch. zu Berlin, aus d. Jahre* 1839, s. 213—240, 247—261.

[2] There are very numerous publications on this organ, of which we are content to notice the following: G. FISCHER *Versuch über die Schwimmblase der Fische*, Leipzig, 1795, 8vo; DE LA ROCHE *Observations sur la vessie aérienne des Poissons*, *Ann. du Mus.* XIV. 1809, pp. 184—217, pp. 245—289; H. RATHKE *Bemerkungen über die Schwimmblase einiger Fische* in his *Beiträge zur Gesch. der Thierwelt*, 4te Abth. 1827, s. 102—120, and his later investigations in MUELLER'S *Archiv*, 1838, s. 413—445, Taf. 12; K. E. VON BAER *Untersuchungen über die Entwickelungsgesch. der Fische, nebst einem Anhange über die Schwimmblase*, Leipzig, 1835, 4to; H. S. R. JACOBI *De vesica aërea Piscium, Diss. inaug.* Berolini, 1840, 4to, under the auspices of J. MUELLER.

bladder is entirely closed. A few fishes have a cellular swimming-bladder, by which *Lepidosteus* in particular is distinguished. The form of the bladder is usually elongate; sometimes provided at the anterior extremity with lateral blind appendages; sometimes with a row of such appendages extending the whole length on each side. In some fishes it is constricted in the middle, and divided into two chambers lying one behind the other. The blood-vessels divide in a fan-like form into fine branches over the internal mucous membrane, or form *retia mirabilia* at particular points, which have been described as red glandular masses. Formerly it was thought that such nets are absent in fishes whose swimming-bladder is provided with a duct; but this, however, is not a general rule[1].

The air contained in the swimming-bladder consists of a mixture of oxygen and nitrogen, with sometimes a small quantity of carbonic acid gas. In fishes of the same species chemical investigation often indicates remarkable differences. According to BIOT and DE LA ROCHE, the quantity of oxygen increases with the depth in which the fishes live; thus in general it is much more abundant in marine than in fresh-water fishes; in the last a considerable quantity of nitrogen is always present, and in the carps it has even been supposed that the air of the swimming-bladder consists of this gas alone; in marine fishes the air of the bladder may contain even eighty per cent. of oxygen gas. This air is secreted by the inner surface of the swimming-bladder, as appears from those fishes that have the bladder entirely closed; but even in those whose swimming-bladder has a duct, it is difficult to suppose, as RATHKE has suggested, that the air penetrates into the bladder from without. More probably the duct serves for the escape of the air.

Opinions differ respecting the use of the swimming-bladder in the animal economy of fishes. The name that has been given to it indicates the presumed connexion with swimming. This is the common opinion, first advanced by BORELLI, according to which the fish by compression or expansion of the bladder can make itself specifically heavier or lighter, and alternately sink and rise in the

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[1] For further particulars on these blood-glands of the swimming-bladder, see J. MUELLER *Abhandl. der Akad. der Wissensch. zu Berlin, a. dem Jahre* 1839, s. 262—271.

water. This compression is effected by motions of the ribs, whilst in addition sometimes proper muscles are present in the swimming-bladder[1]. But in many fishes it is difficult to shew how they are in a condition to expand the bladder and to rarefy the air. Whatever opinion, however, be entertained respecting the use of the organ, it is difficult to explain why, if it really exerts an important influence on the life or the economy of fishes, it should be absent in so many species, and even in some genera of fishes should be present in certain species whilst in others of the same common form it is not found. Certain it is that a bladder filled with air will render specifically lighter the body of the fish, which, without it, is only a little above the specific gravity of water; and since it is placed near the back, that part especially of the body which in other respects is the heavier, so that the centre of gravity of the fish will sink, and its turning belly upwards be prevented. Deep-bodied, compressed fishes have also usually a well-developed swimming-bladder. According to the experiments of MUELLER, however, the fins and especially the vertical fins (dorsal and anal fin) principally resist this upsetting. In some fishes, according to the discoveries of E. H. WEBER, the swimming-bladder is in connexion with the auditory apparatus, as an organ that intensifies and conducts sound. That this bladder is a second respiratory organ and to be compared with the bladder-like lung of certain reptiles, as some suppose, is sufficiently refuted by the course of the blood-vessels; for if this were true it would receive venous and not arterial blood[2].

The secretion of urine is effected by two kidneys, lying upon the spinal column, which are often united with each other at their posterior extremity. In most osseous fishes they extend from the head backwards as far as above the anus. They are usually of a loose spongy tissue; here the difference between internal

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[1] In some of the *Siluridæ* (*Auchenipterus, Euanemus, Synodontis, Doras* and *Melapterurus*) there is a bony lamina that descends obliquely on each side from the first vertebra to the swimming-bladder, and compresses it like a spring. This lamina can be raised by a muscle arising from the cranium, on which the bladder expands. See J. MUELLER *Abhandl. der Akad. d. Wissensch. zu Berlin. a. d. J.* 1842.

[2] G. FISCHER modifies the opinion that the swimming-bladder is a respiratory organ in this way: it is for the respiration of the air contained in the water, whilst the gills serve for decomposing the water; but in the respiration of fishes the water is not decomposed, as has already been noticed above.

and external substance (*substantia corticalis* and *medullaris*) does not exist. The entire substance of the kidneys is formed of cœcal tubes which open into the ureters. These usually coalesce in a bladder, or become wider at their inferior extremity. The bladder is situated upon the rectum and the *urethra* opens behind this[1]. Renal capsules (*renes succenturiati*, *capsulæ renales*), formerly thought to be absent in fishes, occur in the cartilaginous fishes as narrow, elongated, yellow bands situated on the inner side of the kidneys, and in the bony fishes usually as two small, round, whitish bodies, mostly at the posterior extremity of the kidneys[2].

The organs of propagation of fishes are on the whole not very composite. The sexes are always distinct, but often, as in the lower animals, there is a great similarity between the parts that prepare the germ and the seed (ovaries and testes). Sometimes the entire apparatus of the organs of propagation is limited simply to these indispensable and essential parts. Ordinarily there are two ovaries present and two testes; there are however fishes in which these organs are unpaired, of which the examples are more frequent in female specimens. One ovary alone is developed in the perch, in *Blennius viviparus*, *Ammodytes tobianus*, *Cobitis barbatula*, *Cobitis tænia;* in many sharks also (*Scyllium*, *Carcharias*, *Sphyrna*, *Mustelus* and *Galeus*) only one ovary is present, mostly situated on the right side. In most bony fishes the ovaries form two long and large sacs, which lie on each side near the intestinal canal and the liver (the so-called roe). From the inner surface folds arise which ordinarily form transverse partitions; in these folds the eggs are developed, which in some fishes are exceedingly numerous in the spawning-season, sometimes some hundreds of thousands. The inferior part of the ovary is without such plates, and serves only for transmitting the eggs; thus it may be named an oviduct; and here

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[1] See on this subject A. J. D. Steenstra Toussaint *Commentatio de systemate uropoetico Piscium, Ann. Acad. Lugd. Bat.* 1835. The opening of the urethra behind the *anus* is a special characteristic peculiarity of fishes. From this fact Rathke and V. Baer concluded that the kidneys of fishes do not correspond to those of the higher vertebrates, but to the embryonal *corpora Wolffiana* (the primordial kidneys). In the embryo of fishes at least no *corpora Wolffiana*, except these kidneys, are met with. H. Rathke in Burdach's *Physiologie*, II. s. 569; V. Baer *Entwickelungsgesch. der Thiere*, II. 1837, s. 314.

[2] Comp. Stannius in Mueller's *Archiv*, 1839, s. 97—101, Taf. IV.

we find a disposition which in the invertebrate animals is normal, but in the vertebrates does not occur elsewhere, namely that the oviduct is an immediate continuation of the ovary. The two oviducts afterwards meet in a single canal which opens in front of the urethra behind the *anus* in a small groove, sometimes on a papilla. In other fishes (the eels, the salmons, the *Cyclostomes*) the ovary consists of an elongated lamina, which is attached to the spinal column by a duplicature of peritoneum, and has many projecting folds; oviducts are not present; the eggs developed in these folds are detached when ripe, fall into the cavity of the abdomen, and escape by one or two ventral apertures[1]. In the *Plagiostomes* and in *Chimæra* the ovaries are much smaller than in the rest of the fishes; they lie in the anterior part of the abdominal cavity near the liver, and form bunches as in birds; whilst some eggs on the surface are more developed, others as smaller granules lie concealed in the *stroma*. Here there are always two oviducts, even when there is only one ovary. These have a common opening near to or in front of the ovaries, and are by no means immediately connected with them as in the bony fishes. They are very long, provided internally with longitudinal folds, and become wider at the lower part. Above the widening a glandular tissue is situated which surrounds the oviduct as an annular swelling; it is more developed in those which are oviparous, and consists of many cœcal tubes, laid close together, which open into the oviduct[2]. In the viviparous sharks the inferior wider part of the oviduct may be named uterus, which thus is double, as in the marsupial animals and the *ornithorhynchus* in the class of mammals.

The testes (in the bony fishes named *milt*) are in the male individuals placed in the same situation as that occupied by the ovary in the females. They are larger in this class than in any other vertebrate animals, and the secretion of *sperma* is as abundant as the eggs are numerous in the *ovarium*. On the inside of each of

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[1] See a figure of the *ovarium* of the salmon in CARUS *Tabulæ anatom. comparativam illustrantes*, Fasc. v. Tab. iv. fig. vii.; of *Petromyzon marinus* in *Catalogue of the Series of compar. Anatomy in the Museum of the Royal College of Surgeons*, iv. Pl. 59; of the eel, *ibid.* Pl. 60, and in HOHNBAUM-HORNSCHUCH *Diss. inaug. de Anguillarum Sexu et Generatione.* Grijphiæ, 1842, 4to.

[2] In the rays J. MUELLER has figured this part in his great work, *De penitiori glandularum structura*, Tab. ii. figs. 14, 15.

the testes runs the *vas deferens*, and the two unite to form a common canal, longer or shorter, which joins the *urethra*, and thus opens in a groove or on a papilla behind the *anus*[1]. In most osseous fishes the tissue of the testes consists of tubes, of which the blind extremities are directed towards the outside of the organs, sometimes dividing there into two branches, and open on the inside into the efferent vessel[2]. In the eels[3] and in *Petromyzon*, on the other hand, the testes are flat bands like the *ovaria*, of a granular tissue. Efferent ducts are absent; the seed is received by the abdominal cavity and escapes by an aperture behind the vent. In the *Plagiostomes* the *testes* are of a vesicular tissue, and in these vesicles granules are contained which are filled with *sperma*. Fine ducts (*vasa efferentia*) run to the *epididymes*, situated behind the *testes*, and from these arise the two efferent vessels, at first very tortuous, afterwards straighter, which run over the kidneys and finally widen into two *vesiculæ seminales*, which are supplied internally with annular partitions. From these the seminal fluid is conducted to the penis, which lies in the *cloaca*. There are, in addition, behind the pelvis, near the tail, appendages which are supported internally by cartilage; they serve to embrace the female during copulation by affixing themselves to her tail[4].

Most osseous fishes do not copulate, but the males sprinkle the eggs laid by the female with their seminal fluid. It is probable that

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[1] See a figure of the *testes* in *Trigla lyra* in the *Tabulæ* of CARUS cited above, Fasc. V. Tab. IV. fig. 4.

[2] This tubular structure, first observed by RATHKE, was afterwards more fully illustrated by TREVIRANUS and J. MUELLER. See TREVIRANUS *Zeitschr. für Physiol.* II. Darmstadt, 1827, s. 10—13, Tab. III. fig. 4, MUELLER *De penitiori glandular. struct.* p. 104, Tab. XV. fig. 8.

[3] According to SCHLUESSER, it is not improbable that the parts described by HOHNBAUM-HORNSCHUCH as *testes* in eels, are only undeveloped *ovaria*, and that male eels are still unknown. G. SCHLUESSER *de Petromyzontum et Anguillarum Sexu. Diss. inaug.* Dorpati, 1848.

[4] Compare TREVIRANUS *Ueber die Zeugungsorgane des Dornhay, Zeitschr. für Physiol.* II. 1827, s. 3—10, Tab. III.; STANNIUS in MUELLER'S *Archiv*, 1840, s. 41—43. On the sexual organs of fishes consult especially RATHKE *Beitr. zur Gesch. der Thierwelt*, 2te Abth. s. 117—206, and in MUELLER'S *Archiv*, 1836, s. 171—186, and on the development of these parts, *Beitr. zur Gesch. der Thierw.*, 3te Abth. s. 1—18.—Also J. MUELLER *Ueber den körnigen Bau der Hoden bei mehreren Fischen*, in TIEDEMANN and TREVIRANUS *Zeitschr. f. Physiol.* IV. 1831, s. 100—113, and H. STANNIUS *Ueber die männliche Geschlechtstheile der Rochen u. Haien*, MUELLER'S *Archiv*, 1840, s. 41—43.

the males are attracted by the olfactory sense, by which they collect around the females of their species at the season of spawning and come into their neighbourhood. Amongst those which copulate, some species are also oviparous. Only few bony fishes are viviparous, as, for instance, *Anableps*, *Blennius viviparus*. Of the cartilaginous fishes, on the contrary, amongst the *Plagiostomes* the *Rajæ*, in a proper sense, and the species of sharks of the genus *Scyllium* alone, are oviparous. The egg in these rays and sharks has a tough, horny, flat, elongated shell, of which the four corners terminate in the rays in long tortuous filaments, wound round each other.

The development of fishes is distinguished from that of the scaly reptiles, the birds and mammals, in that neither *amnion* nor *allantoïs* is formed. In the beginning that dividing or cleaving of the yolk is perceptible, which we have already spoken of in different classes of invertebrate animals[1]. When the yolk has again become smooth, the germinal disc appears, and as it grows spreads itself over the yolk until it quite surrounds it. After it has thus become a vesicle, or in other fishes even before this period, there arises, in that part of the germ-disc which is first formed, a longitudinal groove as the first commencement of the embryo. Two projecting edges surround this groove and approach each other, whilst at the bottom of the groove the dorsal cord, as the first commencement of the skeleton (comp. above, pp. 5, 8), is formed. The innermost layer of the germ-membrane (the mucous layer) presents a constriction, and is thus divided into a canal situated beneath the dorsal cord and into a vitelline sac. In some fishes this vitelline sac is included in the ventral cavity with the intestinal canal by the walls of the abdomen, formed from the serous layer; there is thus an internal vitelline sac present in these, and the abdomen of the embryo presents an unusual projection (*Cyprinus*, *Perca*, *Salmo*); in others the abdominal covering is drawn together by constriction like the mucous layer, and the vitelline sac hangs on the outside of the ventral cavity, being attached to it by a short pedicle (*Blennius*

[1] Observations on this subject, in eggs of fishes impregnated artificially, have been published by Rusconi, Mueller's *Archiv*, 1836, s. 278—288, Taf. xiii. The eggs acquire an elevation or protuberance, and this, not the entire yolk, is the seat of the regularly increasing grooves. Later observations have shewn that this phenomenon depends upon the development and change of the germinal vesicle.

viviparus, Cottus gobio, Syngnathus). In the *Plagiostomes* (sharks and rays) an external vitelline sac is similarly observed, which here, however, has a longer pedicle, which in some sharks is beset externally with *villi*. In most of these fishes the umbilico-intestinal duct is continued within the abdomen into a second internal vitelline sac: a blind sac, which occupies a large part of the ventral cavity, and is inserted into the anterior bladder-like portion of the intestinal canal above the commencement of the spiral valve[1]. The lateral walls of the body of the embryo, which are at first smooth, suddenly present on each side 5 (or 6) fissures of equal width. Between these fissures four small streaks are formed as the commencement of the branchial arches. In front of the first fissure and behind the mouth arises a wider arch divided by a groove into two parts. The anterior half of this is changed into the under jaw and the various bony pieces which unite it with the cranium. From the posterior half arise the horns of the tongue-bone; at the posterior margin of these parts in bony fishes the gill-covers and the branchial rays are developed at a later period only, the branchial arches being at first unprotected. The unpaired fins arise at first as a long fold of skin, which surrounds the body, and is much more extensive than the future *pinna dorsalis* and *analis*. All the bony fishes whose development has been hitherto observed, quit their egg-covers at a very early period and whilst still imperfectly formed. In the embryos of sharks and rays the filaments which hang freely from the branchial fissures, productions of the internal leaflets of the gills, reminding us of the external gills of larvæ of Salamanders, are especially deserving of regard[2].

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[1] This vesicular part of the intestinal canal was named by COLLINS *bursa Entiana*, after GEORGE ENTE, by whom it was first discovered; *System of Anatomy*, 1685, Tab. 33, fig. 2 *g*. In *Carcharias* and *Mustelus lævis* MUELL. an external vitelline sac alone is present, and this is attached by many folds to the inner surface of the wider inferior part of the oviduct named *uterus*. These sharks have thus a *placenta*, which however differs from that of mammals, and is formed by the vitelline sac. Compare especially J. MUELLER *Ueber den glatten Hai des Aristoteles*, &c. *Abh. d. Akad. zu Berl. Jahrg.* 1840, *Physik-math. Kl.* s. 187—257, with fig.

[2] On the development of fishes, amongst other works may be compared H. RATHKE *Abhandlungen zur Bildungs- und Entwickelungs-geschichte*, II. Leipzig, 1833, 4to, s. 1—68 (on the development of *Blennius viviparus*); V. BAER *Untersuchungen über die Entwickelungs-geschichte der Fische*, Leipzig, 1835, 4to; the same, *Ueber Entwickelungs-geschichte der Thiere*, II. Königsberg, 1837, 4to, s. 295—315; RATHKE in BURDACH'S *Physiologie*, 2te Aufl. II. 1837, s. 276—296; C. VOGT *Embryologie des*

Let us now consider shortly those organs in fishes which have reference to the functions of animal life. Here in the first place the nervous system claims attention. Of this the central parts, the spinal marrow and brain, offer commonly a different relation to each other than in the higher vertebrates. The mass of the spinal marrow or cord, in proportion to that of the brain, is very large; the cord extends, with few exceptions, to the end of the vertebral column. Consequently a *cauda equina* is only seldom present: a disposition by which the last spinal nerves arising far from the place where they pass outwards from the vertebral column, and so also leaving the cord under a very acute angle, lie close together in a bundle[1]. On the under and upper surface the spinal cord is divided longitudinally by a fissure into two lateral parts. In the interior, through the entire cord, there runs a narrow canal which extends into the brain to the fourth ventricle, into which it expands.

The brain is small, not only, as we have said, in proportion to the preponderant spinal marrow, but also to the whole body, of the weight of which it commonly forms less than the $\frac{1}{100}$th or even the $\frac{1}{2000}$th part[2]. This small magnitude of the brain may be inferred from the smallness of the cranial cavity, though even this, at least in bony fishes, is still much larger than the brain which it includes. For there remains between the delicate membrane which immediately covers the surface of the brain and the hard membrane that covers the inner surface of the cranial bones, a space which is occupied by a loose cellular tissue, a species of *arachnoïd*, which is

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Salmones (*Coregonus palæa*, Cuv.) in Agassiz *Hist. natur. des Poissons d'eau douce*, 2 Livr., Neuchatel, 1842; Duvernoy *Sur le développement de la Poecilie de Surinam*, *Ann. des sc. natur.*, 3ième Série, I. 1844, pp. 313—360. Pl. 17. On the development of rays and sharks may be consulted, Rathke *Beiträge zur Gesch. der Thierwelt*, IV. 1827, s. 4—66, and F. S. Leuckart *Untersuchungen über die äusseren Kiemen der Embryonen von Rochen u. Hayen*, Stuttgart, 1836, 8vo.

[1] In the sun-fish (*Orthagoriscus*), according to Arsaky, and also in *Diodon*, according to Owen (*Lectures on Comp. Anat.* II. p. 173), there is a very short, conical spinal cord, with a *cauda equina;* in *Lophius* the cord is also short, but extends as far as the twelfth vertebra; here also there is a *cauda equina*, which in part covers the spinal cord.

[2] In a pike the cerebral mass was found to be $\frac{1}{1305}$ of the weight of the body; in a sheat-fish, *scheidfisch* or sly silurus (*silurus glanis*), only $\frac{1}{1887}$ of it. Comp. Haller *Elem. Physiol.* IV. pp. 5, 6, and Cuvier *Leç. d'Anat. comp.* II. p. 152, where several examples are adduced. The weight of the brain in a full-grown man may be estimated at about $\frac{1}{40}-\frac{1}{41}$ of the weight of the whole body, although such estimates cannot easily be rigorous, since the weight of the human body is so different in different individuals.

saturated with a fatty matter mostly in a fluid state. In younger fishes, however, the brain is relatively larger, and fills the cranial cavity in a greater degree than in older individuals.

In breadth the brain exceeds the spinal cord but slightly, is flat and elongate, and consists of eight lobes partly in pairs, partly unpaired, lying behind one another. The unpaired part that lies in front of the *medulla oblongata* above the fourth ventricle, corresponds to the lesser brain or *cerebellum;* and, however various the opinions of different writers on other points, here there is the most perfect agreement. Internally this part is hollow, for the fourth ventricle at its upper part extends into it. In front of this cerebral mass lie two convex bodies, hollow internally, which in bony fishes constitute the largest division of the brain, whilst in the cartilaginous they are smaller. CAMPER, CUVIER, and amongst the latest writers GOTTSCHE, compare these parts with the hemispheres of the larger brain (*cerebrum*), whilst others place them on a par with the *corpora quadrigemina* of man; HALLER regarded them as the *thalami nervorum opticorum.* In the bony fishes there lie in the interior of these parts and behind, two or four small round tubercles of grey substance, which are wanting in cartilaginous fishes. In these last the two convex bodies are also smaller, and in front of them lies an unpaired hollow eminence, open above (*lobus ventriculi tertii*), which in the bony fishes does not appear as a distinct part. The anterior division of the brain in the osseous fishes is formed of two conical parts, not hollow internally, united by a commissure; from this division arise the long olfactory nerves (the first pair of nerves), issuing from the inferior surface, but fortified in most bony fishes by a swelling at the anterior extremity of these lobes, or by two such in *Murœna.* In the *Plagiostomes* these anterior lobes, broad and hollow within, are united with one another. On the inferior surface of the brain the *hypophysis* or *glandula pituitaria,* sometimes attached to a long pedicle, is seen, near to which on each side lies an oval or kidney-shaped eminence (the *lobi inferiores,* the *tubercula reniformia* of HALLER[1]).

[1] The origins of the optic nerves pass along the outside of these parts, and the third pair of nerves springs from their posterior margin. They are usually compared to the *corpora candicantia* of the brain of mammals, to which notion, however, well-founded objections have been raised by CUVIER. It were more prudent to regard them, with GOTTSCHE, as special parts peculiar to the brain of fishes.

The comparison with the brain of reptiles, and especially the history of development of the brain in higher vertebrates, which is most perfectly known to us in the embryo of the bird, induces us to recognise in the hollow lobes in front of the cerebellum in fishes the union of the *corpora quadrigemina* and of the space for the third ventricle of the brain (*lobi optici*). If this be right, then fishes have no *corpus callosum*, unless a transverse communication between these lobes, which some writers regard as such, deserves that appellation. As little is there a *pons Varolii* on the inferior surface in front of the *medulla oblongata*. In addition to these two negative characters of the brain of fishes, the small development of the *cerebrum* (anterior brain) in comparison with that of the optic lobes, may be assigned as distinguishing the brain of fishes from that of reptiles and birds. Those parts of the brain, which in man are covered above by the hemispheres of the brain, are here placed behind one another as middle and posterior brains[1].

The spinal nerves arise, as in the rest of the vertebrate animals, by two roots, one from the posterior or upper, and one from the inferior strand of the spinal cord. The posterior roots of these nerves, which swell into a ganglion, are the sentient roots, the anterior the motor roots[2]. As to the cerebral nerves, the common type of the vertebrate animals prevails in fishes also, and, with the exception of the *nervus hypoglossus* and *accessorius Willisii*, all the pairs of nerves that spring from the human brain, occur in almost all

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[1] Whenever a *glandula pinealis* is found, as is the case in some fishes, it is situated behind the anterior and in front of the middle lobes of the brain, and thus affords an additional proof that the middle lobes of the brain do not correspond to the cerebrum. See, on the brain of fishes, HALLER *Elem. Physiol.* IV. 1766, pp. 591—596; and more fully in *Verhandelingen van die Hollandsche Maatschappij der Wentensch.* Haarlem, X. 2, pp. 314—386; A. ARSAKY *Dissert. de piscium cerebro et medulla spinali.* Halæ, 1813 (new edition by MINTER, Leipzig, 1836, 4to); CUVIER *Hist. nat. des Poiss.* I. pp. 415—434; C. M. GOTTSCHE *Vergleichende Anatomie des Gehirns der Grätenfische,* MUELLER'S *Archiv,* 1835, s. 244—294, 433—486, Taf. IV. VI. Respecting the reduction of the brain of fishes to the common *typus*, the most important questions are investigated by MUELLER *Physiologie,* I. (third edition, 1838, s. 824—829).

[2] We presume that this physiological truth, of which the discovery is due to C. BELL, is known to the reader; it applies to all vertebrate animals, and is to be regarded, especially since MUELLER'S experiments on frogs (*Physiologie,* I. 3tte Auflage, s. 651—653), as a well established general proposition in our still limited knowledge of nervous function.

fishes[1]. The fifth and the tenth pairs of nerves (the *nervus trigeminus* and *n. vagus*) are remarkably developed. The facial nerve, which by many writers is denied to fishes, appears to be represented in bony fishes by the *opercular branch* of the fifth pair. Of the three pairs of nerves of special sense that for the eyes is the most developed in the greatest number of fishes. The optic nerves arise from the hollow lobes that compose the middle brain, and are at their origin connected by transverse bundles. In the *Plagiostomes* there is a *chiasma* or crossing of the fibres, but in the bony fishes the two nerves themselves lie crosswise upon one another; so that the nerve which springs from the right side runs to the left eye, and that from the left side to the right eye. Here, where the nerves cross one another, they are not connected by any nervous tissue, so that they may be separated and thrown apart without artificial division. The olfactory nerve, when there is no ganglionic swelling in front of the hemisphere of the cerebrum, has such a swelling at its extremity, immediately before it enters the olfactory organ, as in *Gadus*, *Silurus*, most *Cyprini*, and the *Plagiostomes*. The auditory nerve arises, close to the fifth pair, from the *medulla oblongata*. The *n. vagus* arises by two roots from the *medulla oblongata;* the posterior root is the most conspicuous, and the *medulla oblongata* sometimes presents here a considerable swelling (*lobus nervi vagi*[2]) as in *Cyprinus*. This nerve mostly surpasses the *trigeminus* in thickness; its branches run especially to the branchial arches, but besides this to the œsophagus, the stomach, the heart, the swimming-bladder, and in *Torpedo* and *Malapterurus electricus* to the electric organ. Moreover from the *n. vagus* a nerve arises, which runs longitudinally amongst the large lateral muscles, sometimes deeper, in other instances immediately beneath the skin, and which, in those fishes where it lies deeper, gives off a superficial branch which runs longitudinally under the *linea lateralis*. This *nervus*

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[1] In the *Myxinoïdæ* the nerves of motion of the eye are wanting, according to MUELLER. Compare also on the peripheral nervous system of fishes, besides the works already cited, especially BUECHNER *Mémoire sur le syst. nerveux du Barbeau, Mémoires de la Soc. d'Hist. nat. de Strasbourg*, II. 1835, and H. STANNIUS *Das peripherische Nervensystem der Fische.* Mit 5 Steintafeln. Rostock, 1849, 4to.

[2] See a figure of it, given by E. H. WEBER, in MECKEL'S *Archiv*, 1827, Tab. IV. fig. 26.

lateralis cannot be a nerve of motion[1]; its branches, even when it is situated more deeply, go to the skin.

The sympathetic nerve is not present in the *Cyclostomes*, its place being supplied apparently by the *n. vagus*. In the *Plagiostomes* the cephalic portion is wanting; in the bony fishes this portion is situated on the *outside* of the cranium between the *nervus trigeminus*, *glossopharyngeus* and *vagus* on each side, where it forms three ganglia situated behind one another, which are connected by a string running longitudinally, a continuation of the sympathetic nerve of the trunk. Mostly the two sympathetic nerves are united by a transverse branch beneath the bodies of the anterior vertebræ. There are two *nervi splanchnici*, usually one on each side; in different fishes the two arise from one ganglion on the right side, and are then only very rarely united at their origin into one stem[2].

The sense of touch is little developed in fishes. Proper organs of tact, like our fingers, by which the form of objects may be investigated, are wanting, although the lips perhaps may partly serve for tact. Often there are soft conical appendages or filaments at the lips or jaws which, like the whiskers of mammals, serve for the investigation of external obstacles, and put fishes in a condition to avoid them. The entire skin is little adapted to convey a fine sense of touch; it is the seat of a mucous secretion often largely developed, and is usually covered with scales (see above p. 11). The scales present many striæ parallel to the edge, and thus appear to be formed, like the shells of bivalve molluscs, of superposed laminæ, as LEEUWENHOECK supposed. Later observers, however, have opposed this laminated origin of scales as horny plates. The scales are not situated in the epidermis alone, but really in the skin, and are included by it; on a fibrous layer formed of connective tissue there lies a layer of pigment, which is covered by an epidermis

[1] As little is the *ramus lateralis n. trigemini*, less usual in fishes, a motor nerve; it arises as a branch which mounts upwards to the cranium, mostly joined by a branch from the *n. vagus*, and afterwards continues its course along the whole of the back (beneath the dorsal fin). This nerve receives a small branch from all the spinal nerves.

[2] Compare on the *nervus sympathicus* of fishes E. H. WEBER *Anatomia compar. nervi sympathici*. Lipsiæ, 1817, 8vo, pp. 35—66; C. M. GILTAY *Diss. inaug. de nervo sympathico*. L.B. 1834, 8vo, pp. 41—74; and STANNIUS *Das peripherische Nervensystem*, s. 131—143.

formed of flat cells (pavement-epithelium). The scales contain a considerable quantity of phosphate of lime (in well-dried scales it often forms forty per cent. of their weight), and a much smaller quantity of carbonate of lime[1].

Taste in fishes appears to be very small. The part named tongue in fishes consists merely of the anterior extremity of the tongue-bone covered by mucous membrane. Besides, this part is often armed with teeth, and possesses no proper muscles, so that it is moved in conjunction with the branchial arches alone. The glosso-pharyngeal nerve supplies it with no branches, but is distributed chiefly to the first branchial arch, although another branch, usually smaller, is spread upon the palate. If fishes possess the sense of taste, the palate, rather than the tongue, would appear to be its seat.

The organ of smell is commonly placed in front of the eyes on each side, on the upper surface of the head; in the *Cyclostomes* and *Amphioxus* alone it is single or unpaired. In *Lophius piscatorius* the organs of smell appear as two small cups attached by a pedicle to the upper lip. The interior of their cavity is covered by mucous membrane, with folds at the bottom which radiate from a centre, or which form transverse striæ proceeding on each side from a middle axis. In the osseous fishes each nasal cavity has usually two apertures, one in front and one behind. Except in the *Myxinoïds* the cavity of the nose has no communication with that of the mouth, as is the case in vertebrates that breathe by lungs.

The eyes of fishes, the soles (the genus *Pleuronectes*) excepted, are situated on each side of the head, often more above, sometimes quite at the side, as in the hammer-fishes (*Zygænæ*). The bony orbit is not perfectly closed, but open forwards and backwards. The eye-ball is commonly flatter in front and irregularly convex behind. Although capable of little motion, it has still six muscles in most fishes, four straight and two oblique, as in man. In some fishes the

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[1] Compare on the structure of fishes' scales AGASSIZ (*Poiss. foss.*), MANDL (*Ann. des Sc. nat.* 2e Série, Tom. XI. 1839, p. 347, and the objections of AGASSIZ *ibid.* Tom. XIV. 1840, pp. 98 and foll.), and PETERS in MUELLER'S *Archiv*, 1841, *Jahresbericht*, s. 209—216. In the *Ganoïds*, where the scales are covered by an enamel, microscopic investigation indicates bone-corpuscles (*lacunæ*), like those which occur in bone. See WILLIAMSON *On the microscop. struct. of the scales and dermal teeth of some ganoïd and placoïd fishes, Phil. Tr.* 1849, pp. 435—475, with plates.

eye-ball, which in such cases is small, is covered by a production of the skin neither attenuated nor transparent: in the most the skin forms round the anterior margin of the eye-ball a circular fold, and then becoming thin and transparent passes over it as *conjunctiva*. Only few have eye-lids with free edges; some sharks have also a third eye-lid, the *membrana nictitans*. Lachrymal glands are wanting. The external coat (*sclerotica*) is elastic and fibrous; it has on the inside a cartilaginous layer, which sometimes partially ossifies. The cornea is flat, or at least not very convex. On the inside next the *sclerotica* is situated the external lamina of the vascular coat (*choroïdea*), a glistering silvery or gold-coloured membrane, which passes into the iris; to it succeeds the vascular layer, formed of a network of blood-vessels and covered by a layer of black pigment; this last passes at the posterior surface of the iris into the *uvea*. At the entrance of the optic nerve into the eye-ball is situated in most osseous fishes a vascular body, which surrounds the nerve like an incomplete ring (*glandula choroïdalis*, comp. above, p. 34). The place where the optic nerve enters the eye-ball is frequently not in the axis of the eye. The retina arises from a streak or irregular white spot, where the optic nerve, mostly in form of a folded band, is expanded. In many osseous fishes a production of the *choroïdea* as a sickle-shaped band (*processus falciformis*) penetrates the vitreous humour, opposite the entrance of the optic nerve, and attaches itself to the margin of the capsule of the crystalline lens; generally the attachment is effected by means of a transparent button (*campanula Halleri*), of which the structure is not yet sufficiently known. The vitreous humour is more fluid than in the rest of the vertebrates. The crystalline lens is almost spherical and very large; it projects through the pupil at its anterior part. The aqueous humour is present in small quantity alone[1].

The auditory organ of fishes consists exclusively of that part which in the higher vertebrate animals constitutes the *labyrinth*. The external auditory passage, the cavity of the *tympanum*, the *Eustachian* tube and the ossicles of the ear are wanting. The

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[1] Compare ROSENTHAL *Zergliederung des Fischauges* in REIL'S *Archiv*, X. S. 393—414; D. W. SŒMMERRING *De Oculorum hominis animaliumque sectione horizontali*. Gottingæ, 1818, fol. pp. 62—71; GOTTSCHE *Ueber die Retina im Auge der Grätenfische*, MUELLER'S *Archiv*, 1834, I. S. 457—466.

membranous labyrinth in the bony fishes and sturgeons lies for the most part free in the cavity of the cranium at the side of the brain, and surrounded by the same fatty substance; in the *Plagiostomes* and *Cyclostomes* the auditory apparatus is situated on each side of the cranium in a special cavity, and is included in a cartilaginous labyrinth. In almost all fishes three very large *semicircular* canals are present, of which the two perpendicular (the anterior and the posterior canal) have the part between the two in common, and thus together open into the vestibule by three apertures, whilst the outermost, horizontal canal, opens into it by two apertures. This vestibule (*vestibulum*, *alveus communis*) is situated below the semicircular canals, and has an elongated sac as an appendage, which is separated from it by a constriction. The posterior part of this sac has a small vesicular appendage (*cysticula* BRESCHET), whilst at the anterior part of the *alveus communis* there is also a small expansion (*utriculus*, *appendix clavata vestibuli*). In each of these three parts there lies a small stone, of which that which lies in the anterior part of the sac is the largest. These ossicles are hard in the bony fishes, generally grooved, crimped at the margin and sometimes very glistering and of a pure white; in the *Plagiostomes* and sturgeons they are softer and granular; they consist of carbonate of lime[1]. In the *Cyclostomes* neither the stones nor any such sand has been met with. In these the auditory apparatus is also more simple. In *Petromyzon* and *Ammocœtes* two semicircular canals alone are found. They are short and thick, and lie towards the membranous vestibule, into which they open, as well by their broad extremities (the two *ampullæ*), as also by a common aperture at the part where they unite. In *Myxine* and *Bdellostoma* MUELL. the entire membranous labyrinth is a single circular canal, which may be regarded in part as a *canalis semicircularis*, in part as *vestibulum*. In the *Plagiostomes* the cartilaginous labyrinth is prolonged beneath the skin and extends to the upper part of the cranium; in the rays also the membranous labyrinth is prolonged upon the cranium and leads to a membranous sac, which, situated between the cranium and the skin, opens on the skin by one or by three small apertures. These parts are filled with

[1] Compare E. KRIEGER *De Otolithis*, *Dissert. inaug. physiol.* Berolini, 1840, 4to.

a calcareous matter. In some bony fishes the labyrinth is extended by a production which unites with that of the opposite side (*sinus impar*), and afterwards, on the outside of the occiput on each side, terminates in an *atrium* on the first vertebra. Here, by means of a chain of small bones, it is brought in connexion with the swimming-bladder[1], so that by this the intensity of the vibrations of sound may be augmented. In other osseous fishes the swimming-bladder extends, without such a chain of bones, to membranous spaces in the cranium which are in connexion with the auditory apparatus[2].

The muscles of fishes consist of loosely united fibres, generally white. On each side of the trunk a large muscular mass is situated, which extends from the head and the osseous belt of the pectoral fins to the base of the caudal fin, on the rays of which it terminates by tendinous bands. This muscular mass is divided by tendinous strips (*ligamenta intermuscularia*), as though by ribs, into segments lying behind one another; the margins of these strips appear on the surface under the skin as zigzag tendinous incisures (*inscriptiones tendineæ*) descending from the back to the abdomen. This muscular mass is the lateral layer of the trunk-muscles, of which in man the dorsal portion alone is present, and has been developed to form the different muscles of the back. In fishes, on the contrary, it extends over the abdomen. Where ventral fins exist, the two lateral muscular masses separate from each other to leave a fissure in which these fins are received; the pectoral

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[1] These bones were named by E. H. WEBER, to whom we owe their discovery, *Gehörknochelchen, ossicula auditus.* GEOFFROY DE ST. HILAIRE, J. F. MECKEL and SAAGMANS MULDER refer them to the first vertebra; the largest, ensiform, hindmost bone, which is immediately connected with the swimming-bladder, would seem to be the rib of the second vertebra. See in detail the investigations of the author last named in *Bijdragen tot de Natuurk. Wetensch.* VI. 1831, bl. 84—105. According to OWEN these bones, with the bony labyrinth, belong to the splanchnic skeleton. *Lectures,* II. p. 210.

[2] The first good description of the auditory organ of fishes was given by P. CAMPER *Verhandelingen van de Holl. Maatsch. der Wetensch. te Haarlem,* VII. 1, bl. 79—117, with figs. 1763. Great in this respect are the deserts of MONRO and SCARPA. This subject has been treated with great completeness and detail by E. H. WEBER, in his work *De Aure et Auditu hominis et animalium.* Cum tab. X. Lipsiæ, 1820, 4to. Comp. also G. BRESCHET *Recherches anatom. et physiol. sur l'Organe de l'ouie des Poissons,* avec 17 Planches. Paris, 1838, 4to, and J. MUELLER *Ueber den eigenthümlichen Bau des Gehörorganes bei den Cyclostomen.* Berlin, 1838. Mit 3 Kupfertafeln fol. (printed separately from the *Abhandl. der Akad. der Wissensch. zu Berlin, aus dem Jahre* 1837).

fins, situated more on the side, with their muscles pass through a fissure in the anterior part of each of the lateral muscles, which here divide into two bundles. By means of the lateral muscles the spinal column is bent to the right or the left. The principal means of progression for the fish consist in the lateral flexures, the alternate relaxations and curvatures of the tail, or, in the case of cylindrical fishes, as the eel, of the entire trunk[1]. The surface which reacts upon the water may be greater or less in proportion as the vertical fins (the dorsal, anal and caudal fins), of which the rays are capable of separation from each other and of erection, are more or less expanded. This is effected by muscles, two in number on each side of the interspinal bones: one in front and one behind the projecting line seen on each side of these bones. That in front moves the ray forward and thus extends the fin; that behind draws the ray towards the back, or in the case of the anal fin towards the belly, and thus depresses the fin. Above these muscles there is situated on each side of every ray a superficial muscle inserted into the skin; these last, of which the fibres have an oblique direction as regards the large lateral muscles, move the fins laterally.

The ventral and pectoral fins act as oars, and serve the fish principally in directing its course and securing its position in the water. In some fishes the pectoral fins are large enough to be able to support the body in the air for a certain time (flying fishes, *Exocœtus*, *Dactylopterus*). The pectoral fins can be moved from or towards the body, can be expanded and moved up or down. The forward and backward motion is dependent on the osseous belt to which these fins are attached, and is very limited. These fins are moved by muscles which are attached to the inner and outer surface and inserted into the rays. Those of the inner surface draw the pectoral fins nearer to the body (*musculi adductores*), those of the outer surface move them from it (*musculi abductores*). The ventral fins can draw their rays together or render them more remote from each other, can move themselves perpendicularly downwards or horizontally outwards and inwards.

The head is very slightly, if at all, moveable on the trunk; the jaws, the palatine arch, the tongue-bone, the branchial arches, on the

[1] S. J. Brugmans pointed out that the stream of water issuing from the gill-aperture on expiration, also assists the progressive motion of fishes. *Verhandel. der eerste Klasse van het Hollandsche Instituut*, I. bl. 185—217. Amsterd. 1812.

other hand, have great capacity of motion. The principal muscles, which widen the cavity of the mouth and move the gill-covers, are attached to the inner and outer surface of the arch of the palate and to the bones which connect the lower jaw with the cranium.

The restorative power of fishes is limited to the reproduction of the parts of fins which have been removed. Many fishes may attain a great age; carps and pikes have been recorded to have lived more than a century. In general they seek their food, especially marine fishes, by night, and then are most easily captured; perhaps they sleep in the day-time. Many fishes probably are torpid during winter.

Of the instinct of fishes little is known. The principal inclination of the fish is the hunting for food, and most of them feed on living prey. For stupifying it some have the power of giving electric shocks. The most remarkable example of art-instinct in the overpowering of prey, is afforded by an East Indian fresh-water fish (*Toxotes jaculator*), which squirts drops of water upon insects on water-plants in its neighbourhood, to cause them to fall into the water. The instinct which is directed to the preservation of the species, propagation, offers less that is remarkable in this class than in that of insects and birds, although some species are known that prepare a kind of nest under the water for their offspring[1].

Many fishes change their abode at certain seasons of the year. Thus, for example, some fishes in spring or summer ascend the mouths of rivers to cast their spawn, as the shad (*Clupea alosa*); salmons ascend even far inland against the stream of rivers. Some would seem to undertake expeditions annually in countless shoals, as the herrings, which, according to GILPIN, describe in the northern ocean a circuit returning into itself, so that in January and February they appear off *Georgia* and *Carolina*, in April off *New York*, and there in the rivers and bays deposit their spawn, then return to the sea and move towards *Newfoundland*. Afterwards

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[1] To these belongs the φυκὶς of ARISTOTELES, a marine fish, that makes a nest of leaves (*algæ*), *Hist. Anim.* I. VIII. cap. 30 (according to CUVIER a *Gobius*), *Hist. nat. des Poiss.* XII. p. 7, the *Doras Hancockii*, CUV. and VAL., according to the observations of HANCOCK; to these, finally, also different species of fresh-water sticklebacks belong, *Gasterosteus*, where the males build the nests, according to the observations of COSTE, lately published. Compare *Dict. universal d'Hist. nat.* VIII. 1847, pp. 650, 651, *Poissons*, Pl. 20.

they run north-eastwards to the Orkney Islands, where they are found in June, divide at the British Isles about August, and again unite to run towards the south-west in October and November, whilst in December they are found at some distance from the west coast of America, in about 18° or 20° N. L. Then they return northwards to *Georgia*, &c.[1] These results, indeed, are founded upon the supposition that the herring of the east coast of North America belongs to the same species with that of the North Sea, which, however, has been since found not to be the case[2]. On the whole there still prevails much uncertainty respecting the migration of fishes. Most of them do not migrate, or their expeditions are rather to be compared with those of birds of passage, which, without any determinate course, betake themselves now and then from one place to another. Those marine fishes, which may really be named fishes of passage, change in the northern hemisphere the northern for more southern regions in the spring of the year, whilst birds of passage do the same in the autumn. The cause, therefore, of the passage of fishes must be different from that of birds[3].

Some species of fishes can exist for a longer or shorter period on dry land, as the common eels. Different species of *Callichthys* and *Doras* bury themselves in the mud when the ponds in which they live become dry, or even creep, as HANCOCK witnessed in a species of *Doras*, over the ground, sometimes in large troops to another pond. The sand-eel (*Ammodotes tobianus*) lives in the sand and especially in the clayey bottom of the sea, in which it buries itself deep and through which it winds in all directions; it sometimes approaches so close to the shore that it may be dug out at

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[1] *Observations on the annual Passage of Herrings, Transact. of the Americ. Philos. Soc.* Vol. II. Philadelphia, 1786, pp. 236—239.

[2] The herring of New York is *Clupea elongata* LESUEUR. See CUV. et VAL., *Hist. nat. des Poiss.* XX. p. 247. ["There can be no doubt that the herring inhabits deep water all round our coast, and only approaches the shores for the purpose of depositing its spawn." YARRELL *British Fishes*, II. p. 112; see the paper of M^CULLOCH quoted by YARRELL in *Journ. of Roy. Institution, Jan.* 1824.]

[3] A prize essay of MARCEL DE SERRES on the *History of Fishes of Passage* (*Natuurk. Verhandelingen van de Holl. Maatschappij der Wetenschappen te Haarlem*, IIe Verzam. 2e Deel. 1842, 4to) throws little light on this matter, and may be regarded as a failure.

ebb-tide with a spade, as in some parts of Zealand[1]. *Salarias alticus* climbs over the rocks by the aid of its fins, and leaps four or five feet when attempted to be taken. That many fishes, swimming on the surface of the water, often make short leaps into the air, is known to all: the flying fishes (*Exocœtus*), noticed above, can leap full twenty feet whilst flapping with their large pectoral fins.

Fishes, in respect of their residence, may be divided into such as inhabit the sea, and others fresh-water, although some, as we have lately said, migrate from the sea to rivers and from these to the sea. The number of species that dwell in the sea is, however, much larger than those in fresh water, and is to the last probably as 3 : 1. Most of the fresh-water fishes are found amongst the soft-finned (*Malacopterygii*) in the families of the *Salmonacei*, *Siluroidei* and *Cyprinoidei*, of which the last is especially abundant in species; amongst the *Acanthopterygii* the number of fresh-water species may be stated as certainly less than the thirtieth part of all the known species. On the whole the physical distribution of fishes is bounded by narrower limits than that of the other animal species. As a rule, no fishes are found in hot springs, in which many other animals frequently live, although a species of *Cyprinus* (*Leuciscus thermalis*) has been found in the Island of Ceylon in a hot spring of 50° centigr. On high mountain levels, where there is often a luxuriant vegetable growth, and where many birds and insects live, only a few fishes are found in the rivers and ponds, as the *Eremophilus Mutisii* in the river Bogota, 8000 feet above the level of the sea. In the brooks on the highest Altaic mountains no fishes are found. Some fishes live in subterranean lakes.

The geographic distribution of fishes indicates some general results which agree with those presented by molluscs (see above,

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[1] The Dutch reader will here recall probably the well-known romance of BELLAMY, and the lines:

Dan gaat de jeugd met spade en ploeg
Naar't breede vlakke strand, &c.

Anabas (*Perca scandens*), an Indian fresh-water fish, not only quits the water, according to DALDORF and JOHN, but even climbs the palms upon the bank, by aid of the spines on its gill-covers. Other writers, however, and especially HAMILTON BUCHANAN, contradict these statements.

Vol. I. p. 770). There are few species alone which may be regarded as cosmopolitan, and then only in an improper sense, whilst they occur, for example, in most seas only, but not in the North Sea, as *Temnodon saltator*. The fishes of the Mediterranean are met with in part in the North Sea also; but many are peculiar to this large lake, or spread themselves along the west-coast of North Africa to the Atlantic Ocean. The Red Sea is in many respects to be regarded simply as a part of the Indian Ocean, and contains many genera which do not occur in the Mediterranean, and even many species which extend themselves to the extreme limits of the Indian Archipelago, and sometimes even to the Southern Pacific. Amongst the fresh-water fishes, the numerous genus *Cyprinus* L. especially, and the allied genus *Cobitis*, are to be regarded as a group of the Eastern hemisphere, of which the greatest number of species occur in India, whilst only a few are met with in North America and none in South America. On the other hand, the *Siluroids* occur equally in both hemispheres of the earth, although many forms are found in the Western hemisphere alone.

The use which man derives from the fishes is very great. Many races of people live exclusively or principally on fish. Salted or dried, and thus rendered fit for transmission to a distance, they form an important branch of commerce for seafaring nations; they afford us train oil, isinglass, &c. The number of fishes of which the use is injurious, is only small when compared with that of the edible and useful.

The arrangement of fishes is attended with great difficulties, and it seems to be rather the avoidance of what is frail than the attainment of what is perfect, that the most earnest investigations and the most learned disquisitions have yet to offer us.

SYSTEMATIC

ARRANGEMENT OF FISHES.

CLASS XIV.

FISHES.

VERTEBRATE animals breathing during the whole life by persistent branchiæ, having cold blood and a ventricle of the heart single, branchial alone; aquatic, mostly oviparous.

I. Organ of smell unpaired.

SECTION I. *Dermopterygii.*

Fins surrounding the body at the back and abdomen with a cutaneous border: pectoral and anal fins none. Dorsal cord persistent, in place of a vertebral column. (Swimming-bladder none. Ribs none.) Body covered by a soft skin, not scaly.

ORDER I. *Leptocardii.*

Pulsating vessels in place of heart. Blood pale. Branchial sac in front of œsophagus, included in the cavity of body.

Family I. *Amphioxini.* (Characters of the order those of the single family.) Body compressed.

Amphioxus YARRELL (*Branchiostoma* COSTA). Body acuminate at both ends; dorsal fin extended at the back through the whole length, confluent at the tail with the anal. Mouth inferior, presenting a longitudinal fissure, furnished with somewhat rigid cirri (12—15 on each side).

This genus of fishes is the most imperfect of the *typus* of vertebrate animals. There is no brain present, at least not as a distinct

organ; this part of the central nervous system is represented by the anterior obtuse extremity of the spinal cord. The *chorda dorsalis*, terminating in a point at both ends, has two sheaths, from the most external of which a fibrous lamina is extended upwards on each side; these two laminæ approach each other and finally coalesce. In this way a canal is formed above the *chorda dorsalis* in which the spinal marrow is contained. But the entire canal is not filled by this: it is divided by a thin transverse partition into a larger inferior portion inclosing the spinal cord, and a smaller upper portion containing a cellular tissue saturated with fat. Above this last portion the two laminæ unite to form a crest on which the rays of the dorsal fin rest. The mouth is surrounded by two strips of cartilage, consisting of jointed pieces, each of which terminates laterally in a conical point; these points are the supports of the cirri that surround the mouth. Behind the mouth commences the branchial cavity, which is supported by numerous cartilaginous strips and invested by a mucous membrane covered with vibratile cilia; small fissures are left between the strips of cartilage, which do not open on the skin but terminate in the cavity of the body. In front of the anus is an aperture (*porus abdominalis*) by which the water escapes, and which may therefore be regarded as a respiratory aperture, but through it the eggs and the sperma are also evacuated. The intestinal canal, as in the *Ascidiæ* (of the branchial sac of which *Amphioxus* reminds us), commences at the bottom of the branchial cavity, and has a lateral expansion of a green colour terminating in a blind extremity forwards, which probably corresponds to the liver. The intestinal canal throughout its entire extent is beset with vibratile cilia; it has no convolutions, and becomes narrower below; the *anus* is situated at a short distance from the extremity of the body, somewhat to the left side. The sexual organs are in both sexes of the same structure, and form on each side of the abdominal cavity a series of irregular four-sided organs, which extends to the *porus abdominalis*, and are visible through the skin. On the under surface, on each side, a fold of skin has been observed, extending to the *porus abdominalis*, in which a canal is situated terminating close to this last behind and in front in the mouth.

We give the preference to the name *Amphioxus*, although devised a couple of years later than that of *Branchiostoma* for this genus of animals, since the last is less commonly known, and moreover originated in the mistake that the oral cirri are gills.

Compare on this genus:

W. YARRELL *History of British Fishes*, II. 1836, pp. 468—472.

H. RATHKE *Bemerkungen über den Bau des Amphioxus lanceolatus.* Mit einer Kupfertafel. Königsberg, 1841.

J. MUELLER *Ueber den Bau u. die Lebenserscheinungen des Branchiostoma lubricum* COSTA. Mit 5 Kupfert. Berlin, 1844, 8vo.

A. DE QUATREFAGES *Mémoire sur le système nerveux et sur l'histologie du Branchiostome ou Amphioxus, Ann. des Sc. nat.* 3e Série, Tom. IV. *Zool.* 1845, pp. 197—248, Pl. 10—13. The descriptions of the Neapolitan naturalist COSTA (*Cenni Zoologici*, 1834, *Fauna del Regno di Napoli*, 1839), are known to me from citations alone. Also of the paper of J. GOODSIR, *Trans. of the roy. Soc. of Edinburgh*, XV. 1841, I have only been able to consult the short account in the *Ann. of nat. Hist.* VII. pp. 346—348.

Sp. *Amphioxus lanceolatus* YARRELL, *Branchiostoma lubricum.* This species, the only one as it seems of this genus, occurs in different seas, and numerously in some places in the Mediterranean; it buries itself in the sand of the shore; its length is from 1½ to 2". PALLAS, who first described and figured it, held it to be a mollusc, whence he named it *Limax lanceolatus. Spicileg. Zoolog.* Fasc. X. Tab. I. fig. 11.

ORDER II. *Cyclostomi.*

Blood red. Heart distinct. Branchial artery without bulb, furnished at the base with two valves. Body cylindrical. Branchiæ furnished with external spiracles, sacciform, six or seven on each side.

Family II. *Myxinoidei* (*Hyperotreta* MUELL.). Body cylindrical, obliquely truncated anteriorly. Mouth anterior, cirrose; olfactory cavity furnished anteriorly with a tracheal tube leading to an external aperture above the mouth, posteriorly with a canal perforating the palate. Single horny tooth in palate; smaller teeth in a double row on each side in tongue, recurved. Branchiæ on each side with internal ducts leading to the œsophagus.

The work of J. MUELLER, already cited, *Vergleichende Anatomie der Myxinoiden, Abhand. der Koenigl. Akademie der Wissenschaften zu Berlin*, 1834, 1838, 1839, 1842, has, in particular, greatly illustrated this family. The perforated palate, the connexion of the cavities of the nose and the mouth, is not found in other fishes, and is besides a common character of vertebrates that breathe by lungs. The inferior margin of the mouth, since no under-jaw is present, is formed by the anterior extremity of the tongue-bone.

Myxine L. Two spiracles approximate on the ventral surface behind the branchiæ, each spiracle receiving the external ducts of the six branchiæ of its own side. Eyes very small, hidden by muscles.

Sp. *Myxine glutinosa* L., *Gastrobranchus cæcus* BLOCH, LINN. *Mus. Ad. Fred.* Tab. VIII. fig. 4, BLOCH *Syst. Ichth.* Tab. 104; CUVIER *R. Ani., éd. ill., Poiss.* Pl. 120, fig. 3; lives in the North Sea. LINNÆUS referred it to the worms, regarding the two lateral parts of the tongue as transverse jaws (*maxillæ transversales*), which do not occur in vertebrate animals. There is a duct which leads immediately from the œsophagus to the left *spiraculum;* a similar duct occurs also in the following genus, going to the posterior *spiraculum branchiale* of the left side. The animal is about 11″ long.

Bdellostoma MUELL., *Heptatrema* DUMÉR. Branchiæ on each side six or seven, each supplied with an external spiracle. Eyes small, conspicuous through the skin.

Fishes from the southern seas, for which the name *Heptatrema* can scarcely be retained, since individuals are met with having six gill-apertures on each side, or six on the right side and seven on the left; the species are not yet sufficiently defined; they closely resemble *Myxine glutinosa* in internal structure, notwithstanding the external characters; frequently, however, they attain a larger size. There are seven gill-apertures on each side in *Petromyzon cirratus, Bdellostoma Forsteri* MUELL.; see BLOCH *Syst. Ichth.* pp. 531, 533. To this genus belongs a species imperfectly described and badly figured by LACEPÈDE *Gastrobranchus Dombey; Poiss.* I. Pl. 23, fig. 1.

Family III. *Petromyzonini* (*Hyperoartia*): Body cylindrical, with mouth anterior, lip circular or lunate. Olfactory cavity open above by an external nasal foramen, produced posteriorly into a blind canal, not perforating the palate. Thorax cartilaginous, sustaining the branchial apparatus, composed of strips descending on each side beneath the skin from the back towards the ventral surface. Two dorsal fins, the posterior conjoined with the caudal fin.

Petromyzon L. (exclusive of *Petr. branchialis*). Several labial and lingual teeth. Branchiæ open internally in a subœsophagean tube, blind posteriorly. Labial ring circular, margined by many small cirri.

Sp. *Petromyzon marinus* L., BLOCH *Ichth.* Tab. 77, GUÉRIN *Iconogr., Poiss.* Pl. 70, fig. 1, YARRELL *Brit. Fishes,* II. p. 448; *Petromyzon fluviatilis* L., BLOCH *Ichth.* Tab. 78, fig. 1, CUV. *R. Ani., éd. ill., Poiss.* Pl. 120, fig. 1 (named *Petr. marin.*). The first of these species, the marine, comes on the approach of summer into rivers, and attains a length of more than two feet; the last, much smaller, appears to live constantly in fresh water. This species is named *Lamprey* (*Lampetra* from *lambendo petras*), *Prickc*, &c. These animals use their tongue as a sucker, and attach themselves to different bodies; they then inspire and expire by the external branchial

apertures. On the anatomy, the memoir of H. RATHKE (*Bemerkungen über den innern Bau der Pricke, Petromyzon fluviatilis.* Dantzig, 1825, 4to) may be regarded as the chief work.

The Dutch Society of Sciences has published a valuable memoir of Prof. MAX SCHULTZE of Halle, *Die Entwickelungsgesch. von Petromyzon Planeri.* Mit VIII. Taf. (*Natuurkundige Verhandelingen van de Hollandsche Maatschappij der Wetlensch. te Haarlem. Tweede Versameling,* Deel XII, 1856, 4to.) The cleavage of the yolk is entire, and in the first stages of development there is much analogy with that of the frog.

Ammocœtes DUMÉR. Teeth none. Branchiæ open internally in the pharynx. External branchial apertures small, placed in a longitudinal furrow. Upper lip semicircular.

Comp. DUMÉRIL *Dissertation sur les Poissons cyclostomes* (*Magasin encyclopédique,* 1808); RATHKE *Beiträge zur Gesch. der Thierwelt,* IV. 1827, s. 66—102, Tab. II. III.

Sp. *Ammocœtes branchialis, Petromyzon branchialis* L., GUÉRIN *Iconogr., Poiss.* Pl. 70, fig. 3, YARRELL *Brit. Fishes,* II. p. 459. In fresh water in many countries of Europe, keeping mostly at the bottom or in the sand; this species attains a length of 6 or 7".

AUG. MUELLER (*Ueber die Entwickelung der Neunaugen,* MUELLER'S *Archiv,* 1856, pp. 323—339) has found that *Ammocœtes* is the larval form of *Petromyzon.* The perfect state is not attained until the fourth year from the egg.

II. Organ of smell double.

A. Muscular bulb at the base of branchial artery, with numerous valves disposed in longitudinal rows.

SECTION II. *Chondropterygii.*

Fins supported by cartilaginous rays. Pectoral and ventral fins. Skeleton cartilaginous; cartilaginous arches closed, forming a canal for the spinal cord; bodies of vertebræ distinct in most, in some the *chorda dorsalis* persistent, situated under the arches inclosing the spinal cord, continuous. Tail recurved upwards, with caudal fin inferior. Skin mostly rough with small bony scales, or covered with large dispersed scutes, sometimes naked. Mouth situated under the head. (Ribs distinct in most; swimming-bladder none.)

ORDER III. *Desmiobranchii* s. *Plagiostomi.*

Branchiæ adhering to the skin by their outer margin, patent by lateral external apertures on each side. True operculum none.

Mouth a transverse fissure on the lower part of the head. Bones of cranium not distinct by sutures. Copulation.

Compare J. MUELLER *und* J. HENLE *Systematische Beschreibung der Plagiostomen.* Mit 60 Steindrucktafeln. Berlin, 1841, folio.

This order may in many respects be regarded as the most composite and the most highly organised in the class of fishes, whence some recent writers place it at the top of the class and far from the Cyclostomes. The conviction that it is an impossibility to preserve the natural affinity, when animals are arranged in a single line, has withheld us from making such a revolution in the previous and more common arrangement of fishes.

The cranium of these fishes presents no sutures. A single bone attaches the lower jaw to the skull, taking the place of the jugal bone, of the *tympanicum, epitympanicum,* and *præoperculum* (see above, pp. 20, 21). At the posterior margin of this bone cartilaginous appendages are attached digitally, which correspond to the *opercula* of the bony fishes. There are thin cartilaginous strips beneath the skin which support the margins of the external branchial apertures, and replace the more composite apparatus of the Petromyzonines. Hence it is obvious that the apparatus in *Petromyzon* is not homologous with branchial arches.

Above, on the head, with few exceptions, are two apertures behind the eyes, in front of the quadrate or suspensory bone of the lower jaws; they conduct to the mouth and transmit the water that has been distributed to the gills (*foramina temporalia, évents, Spritz-löcher*). A real copulation occurs in these fishes; compare above, pp. 39, 40. All have a spiral valve in the intestinal canal.

Family IV. *Batides.* Body depressed. Branchial apertures on the neck below, five on each side. Eyelids connate with the eyes or none. Cartilaginous belt sustaining the pectoral fins adhering above to the vertebral column.

This family consists principally of the genus *Raja* L., to which, as MUELLER has remarked, *Squalus Pristis* L. might be added, which forms indeed the transition to the following family, but still agrees with the rays in essential characters: the branchial apertures are situated on the ventral surface, &c.

In this family the dorsal fins are commonly far backwards. In some species of rays individuals occur with a membrane on the middle of the disc of the body, as in *Raja clavata;* such varieties

have been regarded incorrectly as distinct species. See a figure in LACEPEDE *Poiss.* I. Pl. VII. fig. 1.

Many species have spines or tubercles on the back, on the fins and the tail, which vary in number and development according to age and difference of sex.

A. *Tail slender. Body discoïdal, broad.*

† *A serrated spur at the base of tail.*

Cephaloptera DUMÉR. (*Pterocephala* SWAINS.). Pectoral fins very broad, acuminate towards the point, produced in front of the head like ears. Teeth small.

Sp. *Cephaloptera Giorna* RISSO, *Raja giorna* LAC., *Poiss.* V. Pl. 20, fig. 3, GUÉRIN *Iconogr., Poiss.* Pl. 69, fig. 4; attains a breadth of more than 4 feet; this species occurs in the Mediterranean, but species from the East Indies, Japan and Brazil are also known.

Ceratoptera MUELL. and HENLE.

Myliobatis CUV. Pectoral fins broad, acuminate towards the apex, interrupted at the sides of head, surrounding the head anteriorly. Teeth large, composed of vertical fibres or cylinders, forming transverse flat laminæ, covering each jaw with mosaic work. Tail flagelliform, very long, armed with a serrated spur behind the dorsal fin.

Sp. *Myliobatis aguila* RISSO, *Raja aguila* L., YARRELL *Brit. Fishes,* II. p. 445, Mediterranean Sea, &c.

Sub-genera: *Rhinoptera* KUHL, *Aëtobatis* MUELL., and HENLE.

Sp. *Aëtobatis flagellum, Raja flagellum.* BLOCH *Syst. Ichth.* Tab. 73, habit. in Indian Sea, &c.

Trygon ADANS. Pectoral fins surrounding the head and often produced into a point in front of head. Disc of body oval, orbicular or obtusely rhombic. Teeth placed in alternate rows, rhombic. Tail mostly of length of body, without finlets, furnished with single or double serrate aculeus.

Add genera *Urolophus* and *Trygonoptera* MUELL. and HENLE.

Anacanthus EHRENB. A genus allied to the Trygons, distinguished by defect of spur in the tail.

Sp. *Trygon pastinacea* BONAP., *Raja pastinacea* L., BLOCH *Ichth.* Tab. 82, C. L. BONAPARTE *Fauna Italica,* 1841, III. Tab. 156; in the Mediterranean and North Sea, &c.

Some species, with very long pectoral fins, and thus a very broad disc, resemble in some degree the preceding genera, but have a short tail. (Sp. *Raja altavela* L., *Syst. nat.* ed. X. BONAP. l. l. Tab. 138, from the Mediterranean Sea.) These species form the genus *Pteroplatea* MUELL. and HENLE.

Raja L. (in part). Pectoral fins surrounding the head produced as far as the ventral fins. Disc of body rhombic. Tail slender, depressed, without spur, bipinnate above, with a membranous border at the sides. Teeth crowded, rhombic, flat, sometimes, especially in males, acute.

This genus is the most numerous in species of the family. These species are often oviparous, whilst all the other rays are viviparous.

Sp. *Raja clavata* L. (and *Raja rubus* GM.), BLOCH *Ichth.* Tab. 83, 84, FRIES, ECKSTROEM *och* SUNDEVALL *Scandinaviens Fiskar*, Tab. 35. The body is thickly beset above with small hooklets and some larger spines, which arise from a flat round root like the head of a nail; upper surface a dull-brown, lower white; this species becomes 2—3 feet large, &c. See, further, ROBIN *Sur un appareil qui se trouve de chaque côté de la queue sur les poissons du genre Raja. Ann. des Sc. Nat.* 3ième Série, Tom. VII. *Zool.* 1845, pp. 195, 302. Pl. 3, 4.

The ventral fins are usually deeply incised and divided into two lobes. From a species in which this was not observed, MUELLER and HENLE form the genus *Sympterygia*.

B. *Tail fleshy, fusiform.*

Torpedo DUMÉR. Body covered by naked unarmed skin, disciform, rotundate. Tail pinnate at the point; dorsal fin above the tail, mostly double. Teeth conical, acuminate, crowded.

Temera GRAY. Dorsal fin none. Teeth flat.

Sp. *Temera Hardwickii* GRAY.

Torpedo auctor. (*Astrape* MUELL. and HENLE, *Narcine* HENLE, and *Torpedo* MUELL. and HENLE). Dorsal fin sometimes single (*Astrape*), mostly double. Teeth acute.

Compare J. F. M. VON OLFERS, *Die Gattung Torpedo in ihren naturhistorischen und antiquarischen Beziehungen erlautert.* Mit 3 Tafeln. Berlin, 1831;—F. G. J. HENLE *Ueber Narcine, eine neue Gattung, nebst einer Synopsis der electrischen Fische.* Mit 4 Steintafeln. Berlin, 1834, 4to.

The species from the Mediterranean all belong to the sub-genus *Torpedo* of the moderns; the exotic species to *Narcine* (*Narcine* and *Astrape*), with small teeth in alternate rows on a plate projecting from the mouth. The name *Raja Torpedo* of the *Systema naturæ* is a collective name, for LINNÆUS referred all his descriptions of these fishes to a single species.

These fishes (Νάρκη, *Torpedo, Zitterroche, Krampfrosche*) have been long known, and were recorded by the antients on account of

their wonderful property of giving painful and paralysing shocks. That this property is an effect of the development of electricity was distinctly proved especially by the experiments of WALSH (*Phil. Trans.* 1774) in the latter half of the preceding century. In the present century also many writers, TODD, H. and J. DAVY, &c. (compare *Phil. Trans. of the Roy. Soc. of London*, 1816, 1832, 1834) have continued these inquiries, and have illustrated by many experiments the chemical and magneto-electric properties of these fishes. The electric organ of the Torpedo is situated on each side of the body and consists of a multitude of hexangular prisms or membranous tubes, arranged side by side perpendicular to the ventral and dorsal surfaces, which present numerous transverse partitions of microscopic delicacy, on which the finest nervous filaments are spread, and between which a fluid is contained. The filaments arise from thick branches of the *nervus vagus* and also from the fifth pair, which run to the electric apparatus.

Compare, amongst the earlier writers, S. LORENZINI *Observazioni intorno alle Torpedini.* Firenze, 1678, 4to, and J. HUNTER in *Philos. Trans.* 1773, pp. 481 and foll.; and amongst the more recent, especially P. SAVI *Études anatomiques sur le syst. nerveux et sur l'organe électrique de la Torpille* (illustrated by beautiful figures, and appended to C. MATTEUCCI *Traité des phenomènes électro-physiologiques.* Paris, 1844, 8vo), and R. WAGNER *Ueber den feineren Bau des electrischen Organs im Zitterrochen.* Mit einer lithogr. Tafel. Göttingen, 1847 (*Aus d. Abhandl. der Königl. Gesellsch. der Wissensch.* III. Bd.).

Sp. *Torpedo ocellata* RUDOLPHI, *Torpedo Narke* RISSO, BLOCH *Ichth.* Tab. 122, BLUMENBACH *Abh. naturh. Gegenst.* No. 57;—*Torpedo marmorata* RUDOLPHI, *Torpedo Galvanii* BONAP., CUV. *R. Ani., éd. ill., Poiss.* Pl. 116, &c.

Rhinobatus SCHN. Disc of body oblong or cordate, acuminate anteriorly. Pectoral fins terminating in front of ventral. Head in front of eyes, carinate. Teeth crowded, arranged in a quincunx. Skin mostly rough, with scales or spines dispersed; a row of spines in the middle of back. Tail with two dorsal fins and a terminal fin bilobed.

Sub-genera: *Platyrhina* MUELL. and HENLE, *Trygonorhina* M. and H., *Rhinobatus* SCHN., *Rhynchobatus* M. and H., *Rhina* SCHN.

Sp. *Rhinobatus lævis* BL., SCHN. *Syst. Ichth.* Tab. 71, GUÉRIN *Iconogr., Poiss.* Pl. 69, fig. 1; habit. in Indian and Red Seas. *Rhinob. Columnæ* BONAP. (*Raja rhinobatus* L.) &c.

Note. *Platyrhina* M. and H. (Sp. *Raja chinensis* LAC.), a genus allied to *Torpedo*, differs in habit from *Rhinobatus*. Comp. Plate in MUELLER and HENLE.

Pristis LATH. Body elongate, depressed anteriorly, covered with small flat scales. Pectoral fins distant from head, not produced to the ventrals. Tail with two dorsal and a caudal fin. Teeth small, crowded upon a plane. Head produced anteriorly into a depressed ensiform process armed with teeth at the margin on each side.

Sp. *Pristis antiquorum* LATH., *Squalus pristis* L., BLOCH *Ichth.* Tab. 120, CUV. *R. Ani., éd. ill., Poiss.* Pl. 117, fig. 2; the *saw-fish* (*serra marina* or *serra pristis*), πρίστις; the name of the animal is borrowed from the weapon with which its head is armed; it measures ¼ of the length of the body, and has on each side from 20 to 30 elongato-conical teeth.

Compare LATHAM in *Transact. of the Linn. Soc.* II. pp. 282 and foll. (*Pristis Perotteti*, from the Senegal, would seem to be found in fresh-water only.)

Family V. *Selachii* (s. *Squali*). Branchial apertures at the sides of neck. Eyelids distinct, with margin free. Cartilaginous belt of pectoral fins imperfect, not conjoined with vertebral column above. Pectoral fins not produced in front of head. Anal fin in many.

The Sharks.—This group is somewhat less numerous in species than the preceding, although about one hundred are known; more than a fourth part of that number live in the seas of our part of the world. In general this group seems, like that of the rays, and even in a greater degree, to belong to the eastern hemisphere of the globe; from the South American coasts, Brazil, and the West Indies, there are only few species, perhaps only one-tenth of the whole number. They all live in the sea, although one species of *Carcharias* is found in the Ganges at a distance of sixty hours from the sea. Of these fishes some are widely dispersed, as *Spinax acanthias* (*Sq. Acanthias* L.), *Mustelus vulgaris* (*Squalus Mustelus* L.), which occur in the Mediterranean, the Atlantic, at the Cape, and even in the South Sea. In this family the largest fishes are found; many are more than six feet, *Selache maxima* (*Squalus maximus*) may be more than thirty feet long.

Squatina DUMÉR. Body depressed; head rotundate, with mouth anterior, eyes small, situated on the upper part of head. Two temporal foramina behind the eyes. Teeth acuminate, conical. Bran-

chial fissures situated in the constricted neck behind the head, approximate. Pectoral fins rhombic, produced anteriorly at the sides of the head. Two dorsal fins above the tail. Anal fin none.

Sp. *Squatina vulgaris* RISSO, *Squalus Squatina* L., BLOCH *Ichth.* Tab. 116; YARRELL *Brit. Fishes*, II. p. 407; in the Mediterranean and North Sea. Compare H. BOURSE WILLS *Dissert. med. inaug., continens observationes anat. de Squatina lævi.* L. B. 1844, 8vo.

Pristiophorus MUELL. and HENLE. Head produced into a flat, oblongo-triangular process serrated on each side. Two long cirri below in middle of snout. Anal fin none.

Sp. *Pristiophorus cirratus, Pristis cirratus* LATH., *Linn. Trans.* II. Pl. 26, fig. 5, Pl. 27, South Pacific, New Holland, Japan.

Notwithstanding the external resemblance to *Pristis* this fish is a true shark, with lateral branchial apertures, which are situated in front of the pectoral fins, whilst in *Pristis* they are placed below them.

Squalus L. (exclusive of some species). Body elongate, with head produced into a snout above the mouth. Branchial apertures at the sides, situated in front of the pectoral fins or above them. Dorsal fins mostly two, the anterior placed nearly in the middle of back before the ventral fins.

A. *Squali with anal fin none.*

Scymnus CUV. Temporal foramina. Teeth acuminate. Dorsal fins two, unarmed, small or moderate, the first at the middle of back or nearer the second.

(Sub-genera: *Echinorhinus* BLAINV., *Læmargus* and *Scymnus* MUELL. and HENLE).

Sp. *Scymnus lichia* BONAP., *Squalus americanus* GM., BONAP. *Faun. Ital.* III. Tab. 142, Mediterranean Sea, Atlantic Ocean;—*Scymnus borealis* FLEMING, *Scymnus micropterus* VALENCIENNES, *Nouv. Ann. du Mus.* I. p. 454, Pl. 20, in the North Sea, &c.

Spinax CUV. (and *Centrina* ejusd.). Temporal foramina. Spine in front of each dorsal fin, free or contained in the anterior part of fin, exsert at the point. Teeth small, acuminate, crowded in several rows.

Sp. *Squalus Acanthias* L., BLOCH *Ichth.* Tab. 85, *Skandinav. Fiskar.* Tab. 46; the *picked shark;* this species is amongst the smaller sharks, and seldom attains a length of 3 feet.

B. *Squali provided with anal fin.*

† *Dorsal fin single.*

Notidanus Cuv. Temporal foramina small. Branchial apertures six on each side (*Hexanchus* Rafin.) or seven (*Heptanchus* Rafin.).

Sp. *Squalus cinereus* Gm., from the Mediterranean Sea.

†† *With two dorsal fins.*

a) *With temporal foramina.*

Cestracion Cuv. Eyes without nictitating membrane. Spine in front of both dorsal fins. Teeth crowded, anterior acuminate, arranged in several rows, posterior flat, rhombic. Head flat above or subconcave.

Sp. *Squalus Philippi* Schn. *Port Jackson Shark, Voyage of Governor* Phillip *to Botany Bay.* London, 1789, 4to, figured opposite p. 383. The teeth are figured in Cuv. *R. Ani., éd. ill., Poiss.* 115, fig. 3, and in Owen *Odontogr.* Pl. 10, 11; Southern Ocean near New Holland, and a very similar species on the coasts of Japan. The only representative of a numerous group of fossil fishes, which lived principally in the coal-periods.

Selache Cuv. Eyes without nictitating membrane. Teeth small, conical, not serrate. Dorsal fins unarmed. Branchial apertures large.

Sp. *Squalus maximus* Guenner, Gmel., Blainv. *Mémoire sur le Squale pélerin, Ann. du Mus.* xviii. pp. 88—135, Pl. vi.

Add genera *Alopias* Rafin., *Odontaspis* Agass., *Lamna* Cuv. Temporal foramina small, sometimes very small, hence often overlooked. Tail in *Squalus vulpes* Gm. (*Alopias* Rafin.) longer than body exclusive of tail.

Mustelus Cuv. Eyes furnished with nictitating membrane. Teeth small, obtuse, rhombic, crowded. Dorsal fins unarmed, first beginning above the termination of pectoral fins or at the posterior margin of these; second dorsal fin opposite the anal. Two posterior branchial apertures above the pectoral fins.

Sp. *Squalus mustelus* L., *Mustelus plebejus* Bonap., *Faun. Ital.* Tab. 132, fig. 1, in the Mediterranean Sea and North Sea; the jaws with a pavement of small teeth, as in many sharks; a very similar species is distinguished by a yolk-sac placenta (see above, p. 41, note) during development; it is the *Mustelus lævis* Muell., the smooth shark, γαλεὸς λεῖος of Aristoteles; see J. Mueller in the *Verhandlungen der Akademie* of Berlin for 1840 (*Mustelus equestris* Bonap., *Faun. Ital.* Tab. 132, fig. 3?).

Triakis Muell. and Henle.

Thalassorhinus Valenc.

Loxodon MUELL. and HENLE.

Galeus CUV. (and *Galeocerdo* MUELL. and HENLE). Teeth acute, with margin crenate or serrate.

b) *Temporal foramina none.*

Carcharias CUV. Eyes furnished with nictitating membrane. Teeth acute, serrate.

Sp. *Squalus glaucus* L., BLOCH *Ichth.* Tab. 86, &c.

Add sub-genera *Tricenodon* MUELL. and HENLE, *Prinodon, Aprion, Physodon* VALENC., *Scoliodon,* on which see MUELL. and HENLE l. l.

Sphyra nob. *Sphyrna* RAFINESQUE, BONAP., MUELL. and HENLE, *Zygæna* CUV. Body elongate, with head transverse, broad, and eyes lateral, supplied with nictitating membrane. Two unarmed dorsal fins; anal fin. Temporal foramina none. Teeth acute.

Hammer-fish. In no other vertebrate animal does the head present so strange a form as in this fish. It is prolonged in front of the mouth into two transverse arms. It is only in the head of certain dipterous insects (*Achias, Diopsis*), or in the position of the eyes upon long pedicles in many decapod crustaceans, that we find a corresponding disposition.—The nasal apertures are situated along the anterior margin of the broad head. The name *Sphyrna* of RAFINESQUE, which we think ought to be changed into *Sphyra* (*σφῦρα, hammer*), is preferable to *Zygæna,* already given to a genus of *Lepidoptera.*

Sp. *Sphyra malleus, Squalus Zygæna* L., in the Mediterranean Sea; and some other species in various other seas. Compare VALENCIENNES *sur le sous-genre Marteau, Mém. du Mus.* IX. 1822, pp. 222—228, Pl. 11, 12. With the exception of the singular head this genus is not very distinct from *Galeus* and *Carcharias.*

Scyllium CUV. (species of *Squalus* L.). Body elongate, with head short, obtuse. Anal fin. Two dorsal fins remote, the first placed above the ventrals or behind them. Temporal foramina. Eyes without nictitating membrane. Nostrils approximate to mouth; space between the nostrils and the quadrangular bone circumscribed by two parallel grooves running from the nostrils to the mouth.

Dog-fish. The teeth are provided with three points, of which the two lateral are smaller. The dorsal fins are situated far backwards, as in *Scymnus.* These species are oviparous.

Sp. *Scyllium canicula, Squalus Canicula* L., BLOCH *Ichth.* Tab. 114, BONAP. *Faun. Ital.* Tab. 131, fig. 1, &c.

More than half the known species of this genus are from the southern hemisphere, principally round the southern coast of Africa.

Add genera *Pristiurus* BONAP., *Hemiscyllium* MUELL. and HENLE, *Chiloscyllium* MUELL. and HENLE, *Crossorhinus* MUELL. and HENLE, *Ginglymostoma* MUELL. and HENLE (*Nebrius* RUEPPELL), *Stegostoma* MUELL. and HENLE.

ORDER IV. *Eleutherobranchii* s. *Holocephali.*

Branchiæ not affixed by their outer margin, covered by an operculum, emitting the water by a single aperture on each side behind the head. Dorsal cord persistent.

Family VI. *Chimæroïdei.* Cranium fibroso-cartilaginous, continuous, produced below on each side into an articular process for the lower jaw. Operculum small, adhering to the hyoïd arch, sustaining rays posteriorly. Rays of branchiostegous membrane flat, concrete at the base, conjoined with the rays of operculum, and contiguous to them. Four fissures between the branchiæ on each side. Temporal foramina none.

These fishes approach the sharks very nearly, but are distinguished by many aberrant characters from these and all other fishes. In the rest of the fishes that have a lower jaw this is always connected with the cranium by one or more separate bones (*os quadratum* or *suspensorium*); in *Chimæra* such a distinct bone is not present, but is replaced by a process from the cranium. Also the bones of the upper jaw and the palate are fused with the skull, without any separation or traces of suture. The *chorda dorsalis* presents numerous small cartilaginous rings in its sheath, and in this way offers some resemblance to an *aspera arteria;* cartilaginous laminæ (much less numerous than these rings) form the arches of the vertebral column (*neurapophyses*). The anterior part of the column, with which the skull is connected by articulation, is flatter and formed of a single piece; above this is a perpendicular cartilaginous lamina to which the large spine, situated in front of the first dorsal fin, is affixed.

See SCHULTZE in MECKEL'S *Archiv für die Physiol.* IV. s. 348, Tab. IV. fig. 3, and the figure of the skeleton of *Chimæra monstrosa* in ROSENTHAL *Ichthyot. Tafeln*, XXVII. Compare with this especially J MUELLER in his *Vergl. Anatomie der Myxinoiden*, I. 1835, s. 136—138, s. 153—159, Tab. V. fig. 1, 2 (two skulls of *Callorhynchus*).

In the lips and at the side of the mouth there are also special cartilages, which correspond to the cartilaginous parts of the oral ring in *Petromyzon*.

Chimæra L. Body elongate, fusiform. Tail pinnate below, long, ending in a thread. Osseous scutes in the jaws in place of teeth, two on each side in the upper jaw, one in the lower jaw. Mouth situated under the head. Two dorsal fins; the first armed with a strong spur, situated above the pectoral fins.

Callorhynchus GRONOV., CUV., *Chimæra* CUV.

Sp. *Chimæra monstrosa* L., BLOCH *Ichth.* Tab. 124, CUV. *R. Ani., éd. ill., Poiss.* Pl. 113, fig. 2; in the North Sea and the Atlantic Ocean;—*Chimæra callorhynchus* L., BLOCH *Syst. Ichth.* Tab. 68, GUÉRIN *Incongr., Poiss.* Pl. 67, fig. 3, from the South Sea.

SECTION III. *Ganolepidoti.*

Fins supported by osseous or cartilaginous rays. Skeleton in some osseous, in others cartilaginous. Cranium in part osseous. Dorsal cord persistent in many. Branchiæ covered by operculum, free. Scales osseous, covered with a glassy substance, shining; skin sometimes naked. Swimming-bladder, open by a duct to the œsophagus. Caudal fin mostly asymmetrical, with the supports of the rays adhering beneath the spines of the vertebræ produced in the direction of the upper margin of fin. Pectoral and ventral fins, the ventrals placed behind the pectorals.

The fishes united by AGASSIZ under the name of *Ganoïds* are represented in the present age of the world, besides the cartilaginous sturgeons, only by a few osseous fishes, but form a large division of the class, if we take into account the fishes of earlier periods of our earth. We venture to change the name of *Ganoïds* into *Ganolepidoti*, and adopt the division in the same sense as that according to which it has been more closely limited by JOH. MUELLER. These differ from the osseous fishes in the form of the heart, in the presence of a spiral valve (sometimes rudimentary) in the intestinal canal, in the optic nerves not lying crosswise over one another, but being connected at their origin by a *chiasma*. In the most there is a half branchia in front of the branchial arches on the inner surface of the operculum.

See J. MUELLER, *Abhand. der Königl. Akad. der Wissensch. zu Berlin*, 1844, and printed separately, *Ueber den Bau und die Grenzen der Ganoiden.* Berlin, 1846, folio.

ORDER V. *Sturiones* (*Chondrostei* MUELL.).

Skeleton cartilaginous. Lower jaw attached to the cranium by means of a suspensory formed of three parts. Rays of branchiostegous membrane none. Tail asymmetrical, with fin adhering beneath the spine of back.

Family VII. *Sturiones.* (Characters of the order those also of the single family.)

Acipenser L. Body with an armour of osseous scutes, disposed in five longitudinal rows. Head produced beyond the mouth into a triangular apex, flat below. Cirri in front of the mouth inferior and edentulous.

Scaphirhynchus HECKEL. Temporal foramina none. Body behind the pectoral fins covered everywhere with large scales, depressed.

Sp. *Scaphirhynchus Rafinesquii* HECKEL, *Annalen des Wiener Museums* I, Wien, 1836, pp. 76—78, Tab. VIII; North America, in the Ohio and Mississipi; attains a length of 2′—3′.

Acipenser L. Temporal foramina. Rows of scutes extending as far as tail, skin naked in the interstices, rough with small dispersed squamules.

Sp. *Acipenser sturio* L., BLOCH, Tab. 88, BRANDT u. RATZEB. *Mediz. Zool.* II. Tab. 3, fig. 1, the *sturgeon;* attains a length of 6—10 feet; the dorsal scutes are highest in the middle; the filaments beneath the head are without appendages and terminate in a point. In other species they are flat like a band (*Acipenser huso* L., BLOCH *Ichth.* Tab. 129, BRANDT u. RATZEB. l. l. Tab. 1 *a*, *Suppl.* fig. 1), or with small appendages like fringes.

The sturgeons live in the seas of the northern hemisphere, and from thence ascend different rivers. They attain a remarkable size (*Acipenser huso*, ex. gr. 25 feet). Most of the species belong to Eastern Europe and Western Asia (Black Sea, Caspian Sea). From the roe caviar is prepared, from the swimming-bladder isinglass. To prepare the last (*Hausenblase* from *Hausen*, the German name of *Huso*), of which the best kind comes from Astracan, the swimming-bladder is laid in warm water, cut open, washed and exposed to the air, so that the internal silvery membrane lies uppermost; this having been removed by rubbing, the external membrane is dried.

Compare on this genus BRANDT u. RATZEBURG *Mediz. Zool.* II. s. 1—30, s. 349—355, and FITZINGER u. HECKEL *Annalen des Wiener Museums*, I. s. 261—326, Tab. 25—30. In some species there are two rows of ventral scutes, little developed, or in old individuals they are very flat (*Acip. ruthenus* L.), on which are founded the statements of some writers that there are sturgeons with only three rows of scutes.

MODESTE KILTARY *Recherches anatom. sur les Poissons du genre Acipenser. Bulletin de Moscou*, 1850, II. pp. 389—445, Pl. VI. VII.; *Ostéol. du crâne.*

Spatularia SHAW. Body elongate, naked; caudal fin below the vertebræ, furnished with a lunate lobe. Head produced beyond the jaw into an appendage, depressed, broad, reticulate, osseo-cutaneous. Branchial aperture large; operculum extended posteriorly by a cutaneous lobe, elongate, acuminate. Temporal foramina small. (Osseous operculum adhering to the suspensory bone of lower jaw, digitato-laciniate posteriorly. Osseous lamella conjoined to the hyoïd arch on each side, formed of the concrete rays of the branchiostegous membrane).

Sp. *Spatularia folium, Polyodon folium* LACÉP. *Poiss.* I. Pl. XII. fig. 3, GUÉRIN *Inconogr., Poiss.* Pl. 67, fig. 2. There is here no half gill on the gill-cover, as in *Acipenser;* the dorsal fin is placed more forward than in that genus, somewhat before the anal fin. MAUDUIT first described a fish of this kind under the name of *Squalus spatula, Journal de Physique*, 1774, pp. 384—386, Pl. II. fig. 1; this was without teeth. In other individuals there are numerous very small teeth in two rows in the upper jaw, and in one row in the lower jaw. RAFINESQUE accordingly has distinguished two genera, *Planirostra* and *Polyodon* LAC.; since however the large specimens (of 3 or 4 feet) are edentulous[1], and the small ones (of ½ foot or less) possess teeth, the opinion of VALENCIENNES, that the difference depends upon age, seems to me probable, and at least the adoption of two genera is the less advisable as long as the specific difference is not sufficiently demonstrated. These fishes live in the rivers of North America. The cranium is quite osseous at the upper part, and the sutures (at least those between the frontal bones) are as conspicuous as, for instance, in the pike; so that, according to the characteristics which CUVIER gives for the *Chondropterygii*, *Spatularia* ought not to be united to them. The bony head, as far as relates to the jaws and the tongue bone, is figured by J. MUELLER, *Osteologie der Myxinoiden*, Tab. V. fig. VII; with which figure a specimen in the *Rijks-Museum* corresponds.

ORDER VI. *Ganolepidoti* (*Holostei* MUELL.).

Skeleton osseous. Body covered with scales, mostly rhombic, not imbricate, osseous, with vitreous substance externally.

Family VIII. *Sauroidei* AGASSIZ. Teeth conical, acute, in a single row in each jaw; small, crowded teeth behind this row, and in the palate. (Body elongate.)

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[1] The specimen, however, described by MAUDUIT was only 5 inches in size, but perhaps the small teeth were overlooked. Since the teeth are attached to the mucous membrane alone, they are always missing in the skeleton.

We unite three genera here, of which perhaps each might, with as much propriety, be placed in a distinct family, as MUELLER forms of *Lepidosteus* and *Polypterus* two distinct families. *Amia* L. ought also to be joined with these genera, as has been shewn by VOGT and MUELLER. Yet *Amia* can be brought into no nearer connexion either with *Lepidosteus* or with *Polypterus*. Hence for this genus also a distinct family would be required. In the arrangement of CUVIER these three genera, with many other osseous fishes, are placed in the family of the *Clupeacii*, amongst the *Malacopterygii abdominales*.

The family of the *Sauroidei* of AGASSIZ contains a great number of extinct genera, which are no longer met with after the Jura-formation, as *Diplopterus*, *Pygopterus*, *Saurichthys*, &c. More numerous still are those *Ganolepidoti* which are referred by AGASSIZ to another family, quite extinct, that of the *Lépidoides*, to which the genus *Palæoniscus* belongs[1]; these are distinguished commonly by small teeth. A third family of the *Ganolepidoti*, characterised by flat, round teeth arranged in many rows, that of the *Pycnodontes*, is also entirely extinct. To this is referred the genus *Placodus* AGASS., with very large flat teeth in the palate, of which the remains are found in the *Muschelkalk*. See AGASSIZ *Poiss. foss.* II. 2, pp. 217—222, Pl. 70. The limits of this Hand-book do not permit us to enter into further particulars concerning these extinct genera of fishes.

Lepidosteus AGASSIZ (*Lepisosteus* LACEP.). Jaws produced, narrow. Hard osseous scales, rhombic, arranged in oblique rows descending backwards from the back towards the belly. Branchiostegous membrane with three rays. Dorsal fin small, remote towards the tail, placed above the anal or a little behind it. First ray of dorsal fin, of anal, of pectoral and ventral fins and the external rays of caudal fin, covered with aculeate imbricate scales, serrate. Vertebral column produced in the direction of the superior margin of caudal fin.

Sp. *Lepidosteus osseus* LAC., *Esox osseus* L., *Lepidosteus Bison* DE KAY, BLOCH *Ichth.* Tab. 390, AGASSIZ *Poiss. foss.* II. Tab. A (except fig. of skeleton);—*Lepidosteus spatula* LAC. *Poiss.* V. Pl. 6. fig. 2; with a flat head and shorter jaws; this species becomes 7 feet long. RAFINESQUE

[1] In the *Kupferschiefer* a species of it occurs which, in honour of the Geologist who illustrated this formation so greatly by his investigations, has been named *Palæoniscum Frieslebenense* (BLAINVILLE *Nouv. Dict. d'Hist. nat., nouv. édit.* XXVII. p. 320), or *Palæoniscus Frieslebeni* AGASS. CUVIER had already observed the resemblance of these fossil fishes to *Lepidosteus* and *Acipenser*, *Rech. s. l. Ossem. foss.*, 3ième éd. V. 2, pp. 307, 308.

distinguishes various other species. They are fresh-water fishes of the new world, principally from N. America.

The caudal fin, as in the sturgeons and sharks, is attached to the under side of the vertebral column. The spinous covering of the first fin-rays (AGASSIZ names these parts *fulcra*) is a character which also occurs in many *Ganoleptoti* of the former world. There is a half gill attached to the gill-cover. A swimming-bladder is found, entirely cellular and very long, extending to the *anus;* it is divided into two lateral halves, and communicates by a longitudinal opening (*ylottis*) with the œsophagus below the uppermost *ossa pharyngealia;* see my figure of it in MUELLER'S *Archiv*, 1841, Tab. X. Fig. 4. The anatomy of this fish has been illustrated principally by the investigations of JOH. MUELLER in his work lately cited, *Uber den Bau und die Grenze der Ganoiden.*

Polypterus GEOFFR. Head oval, rotundate anteriorly, depressed above. Two cirri above the mouth. Two spiracles at the sides of head. Scales hard, osseous, rhombic, arranged in rows running obliquely backwards. Branchiostegous membrane with a single, flat ray. Caudal fin rotundate. Dorsal fins numerous, all supported anteriorly by a single ray sustaining soft transverse rays at its posterior margin. Anal fin small, situated near the caudal.

Sp. *Polypterus bichir* GEOFFROY SAINT-HILAIRE, *Ann. du Mus.* I. 1802, pp. 57—68, Pl. V., AGASSIZ *Poiss. foss.* II. Tab. C; with 16 dorsal fins; this fish lives in the Nile, and attains a size of about 2′; another species from the Senegal has only 10 dorsal fins, *Pol. Senegalus* CUVIER, GUÉRIN *Magas. de Zool.* 1839, *Poiss.* Pl. I; finally, a third species from the *White Nile* has lately become known under the name of *Polypterus Endlicheri*, in KOTSCHY *Abbildungen u. Beschreibungen neuer Thiere u. Pflanzen.* Stuttgart, 1849, Tab. XXII. fig. 1; it has 12 dorsal fins.

These fishes have no gill on the gill-cover. The swimming-bladder is long, sacciform, double, and without cells, with fine longitudinal folds internally. It opens *on the under side of the œsophagus.* See GEOFFROY *op. cit.* p. 65, and J. MUELLER in his *Archiv*, 1841, s. 224, 225. F. LEYDIG *Histologische Bemerkungen über Polypterus bichir. Zeitschr. für wissensch. Zool.* V. s. 40—74, Taf. II. III.

Amia L. Head osseous, depressed, rotundate anteriorly. Nasal cirri two. Body covered with large scales, rounded at the free margin. Branchiostegous membrane with 10—12 rays. Dorsal fin long, depressed. Anal fin short. Caudal fin rotundate, with rays adhering to the inferior and posterior margin of vertebræ running obliquely upwards through the fin.

There are various species of this genus, all from fresh-water in North America. What species LINNÆUS indicated by his *Amia calva* cannot be determined with certainty; see VALENCIENNES in CUVIER et VALENCIENNES *Hist. nat. des Poissons*, XIX. (1846), pp. 402—432.—*Amia calva*

BONATERRE *Enc. Méth., Poiss.* Pl. 99, fig. 408, BLOCH, SCHNEIDER *Syst. Ichth.* Tab. 80 is *Amia lentiginosa* VAL.

The swimming-bladder is cellular and double. There is no gill on the gill-cover. Compare H. FRANQUE *Diss. inaug. nonnulla ad Amiam calvam* L. *accuratius cognoscendam*, Berolini, 1847, under the direction of J. MUELLER, with figure of the skeleton, the brain, the heart, and the viscera.

B. Arterial bulb elastic, with two valves at the base. (Comp. above, p. 60.)

SECTION IV. *Osteopterygii.*

Fins supported by osseous rays. Skeleton osseous. Dorsal column composed of distinct vertebræ. Branchiæ free. (Optic nerves decussating or placed cross-wise with respect to each other.)

ORDER VII. *Lophobranchii* CUV.

Branchial laminæ broad, clavate, not numerous, arranged in a double row along the branchial arches, folded transversely. Branchial aperture small, superior, with a large operculum fixed to the skin throughout nearly its entire circumference. Rays of branchiostegous membrane small, very thin. Body loricate, angular.

Cluster-gilled. The singular structure of the gills was first, as it seems, remarked by TIEDEMANN (MECKEL'S *Archiv für die Physiol.* II. 1816, s. 110—112, Tab. II. fig. 7, 8), but more accurately investigated by RATHKE (*Ueber den Kiemenapparat*, s. 50, 51, Tab. IV. fig. 2) and by RETZIUS. The deviation from the usual structure of gills is, according to these researches, rather apparent than essential. RATHKE denies gill-rays to these fishes, which however, according to my observations, is incorrect.

All the species belonging to this order are of small size; only a few grow to the length of 1′.—In the *sea-horse* (*Syngnathus hippocampus* L.), a species of this order, a hybernation has been observed, during which the respiration is diminished; see RUSCONI in MECKEL'S *Archiv f. d. Physiol.* V. s. 268—270.

The eggs are carried under the abdomen or at the base of the tail, mostly under two longitudinal folds of skin which close like folding doors, and in fact, as ECKSTROEM and other Northern writers have observed, by *the male*, to whose protection the female consigns them, and with whom the young ones, when born, continue to live for a time. *Die Fische in den Scheeren von Mörkö, beschrieben von*

C. U. ECKSTROEM. Berlin, 1835, 8vo, s. 122, 132, 133. In *Solenostomus* the ventral fins form a sac, which serves a similar purpose.

Family IX. *Lophobranchii.* (Characters of the order those also of the single family.) Mouth edentulous.

Pegasus L. Snout elongate, with mouth below. Body depressed. Ventral fins narrow, setaceous or cirriform, behind the ample pectorals. Dorsal fin opposite to anal.

Sp. *Pegasus draconis* L., BLOCH *Ichth.* Tab. 109, figs. 1, 2, *Syst. Ichth.* Tab. 107; a figure of the skeleton is to be found in ROSENTHAL *Ichthyot. Tafeln,* Tab. X. figs. 13—17; the *sea-dragon.* The broad pectoral fins resemble expanded wings; these small, singularly formed fishes are found in the East-Indian seas.—*Pegasus natans* L., GRONOV. *Zoophyl.* I. Tab. XI. figs. 1, 2, with an elongated, thinner body, and a long snout. (The figure in CUVIER *R. Ani., éd. ill., Poiss.* Pl. 111, fig. 2, does not represent this, but the preceding species.) A third species recorded by LINNÆUS, *Pegasus volans,* is unknown to me.

Solenostomus SEBA, LACEP. Snout elongate, compressed, with mouth terminal. Ventral fins placed behind the pectorals, very large, concrete with each other, and connected to the sides of body. Dorsal fins two, posterior opposite to anal. Caudal fin acuminate, with middle rays elongate.

Sp. *Solenostomus paradoxus* LAC., *Fistularia paradoxa* PALL., *Spicil. Zool.,* fasc. VIII. pp. 32—35, Tab. IV. fig. 6; from Amboyna, &c., attains a size of 2″.

Syngnathus L. Snout elongate, tubular, with mouth terminal. Ventral fins none. Dorsal fin single.

In some the trunk is higher than the tail, and bent in a curve; they form the sub-genus of the sea-horses, or

Hippocampus CUV.

Syngnathus hippocampus L., is a collective name, under which different species are included. Sp. *Hippocampus brevirostris* CUV., YARRELL, *Brit. Fishes,* II. p. 342; GUÉRIN *Iconogr., Poiss.* Pl. 65, fig. 2. These fishes have no caudal fin; the tail is prehensile or volute, by which they hang upon marine plants; the females have a small anal fin, which is wanting in the males[1].

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[1] A species from New Holland with leaf-like appendages, *Syngnathus foliatus* SHAW, is figured and described by LACEPÈDE, *Ann. du Mus.* IV. pp. 203, 204, Pl. 58, fig. 3, *Syngnathe à banderolles.*

In others the body is of a more uniform thickness and much elongated; they are named *needle-fishes*, and form the sub-genus:

Syngnathus Cuv.

* *With pectoral and caudal fins none.*

Sp. *Syngnathus Ophidion* L., Yarrell *Brit. Fishes, Suppl.* II. p. 47, Eckstroem, l. l. Tab. VI. figs. 3, 4; greenish 6″—9″ long. A low dorsal fin is the only fin which this animal possesses; in the early stage of development, however, pectoral fins are present. The male carries the eggs under the flat abdomen in small cavities or cells placed longitudinally in three rows, and not covered by any valves or longitudinal appendages of skin.

** *With pectoral and caudal fins.*

Sp. *Syngnathus Acus* L., Cuv. *R. Ani., éd. ill., Poiss.* Pl. III, fig. 1, Yarrell *Brit. Fishes*, II. p. 325, Eckstroem l. l. fig. 1, 2, &c. These little animals feed principally on small crustaceans (*Palæmon*, &c.)

Compare on this genus, and especially in what relates to the details of anatomy and development, Retzius in Oken's *Isis*, 1835, s. 396—404, Taf. XI. (from the *Trans. of the Acad. of Stockholm* for 1833); H. Rathke *Reise-Bemerkungen aus Tauricn.* Riga u. Leipzig, 1837, 4to, s. 152—178; Fries in Wiegmann's *Archiv f. Naturgesch*, 1832, s. 236—256, V. Siebold in Erichson's *Archiv*, 1842, s. 292—300.

Order VIII. *Pectognathi* (s. *Plectognathi* Cuv.).

Branchiæ pectinate, with lamellæ narrow, numerous. Upper jaw-bones united to the sides of intermaxillary bones by immoveable connexion. Palatine arch immoveable. Body covered either with multangular scutes or with spines and rough scales. Swimming-bladder in most large, always destitute of duct. Opercula; rays of branchiostegous membrane covered with a dense membrane.

Pectognathi (from πήκτος, *coalescent, fast, connected*, and γνάθος *the jaw*), *bony fishes* with jaws coalescent. With the exception of the sub-genus *Triacanthus* Cuv. (*Balistes biaculeatus*) all are destitute of ventral fins. Most of the species occur in the seas of hot countries, principally in the Indian Sea and South Pacific.

The characters of this order were first propounded by Cuvier in his *Mém. sur la Composition de la Machoire supérieure des Poissons; Mém. du Mus.* II. 1815, p. 102, *et suiv.* See Camille Dareste, *Rech. sur la Classification des Poissons de l'ordre des Plectognathes. Ann. des sc. natur.* 3e Série, XIV. *Zool.* 1850, pp. 105—133.

Family X. *Gymnodontes* CUV. Jaws at the anterior part exsert from the mouth, covered with an ivory substance made up of very small concrete teeth.

In these fishes the three anterior branchial arches alone carry gills, the fourth does not.

The structure of the teeth has been described by CUVIER (*Leç. d'Anat. comp.* III. pp. 126, 127, Pl. 32, fig. 8), and afterwards with greater detail and exactness by OWEN (*Odontography*, pp. 77—82, Pl. 38, 39). Besides the dental envelope in front of the jaws, there is seen in *Diodon* in the upper and lower jaw, behind the margin, a flat tubercle divided in the middle, with transverse striæ on the surface, formed by the projecting edges of transverse laminæ of teeth placed one behind the other. In some species of *Tetrodon* a similar tubercle with enamelled teeth, but much smaller, is found in the upper jaw; in others it is wanting both in the upper and under jaws.

Orthragoriscus SCHN. Body compressed, not aculeate, truncated. Maxillæ undivided in the middle. Dorsal and anal fins remote, high, united with the caudal at the posterior truncated part of the body.

Sun-fish. The fishes of this genus have no swimming-bladder; their branchial membrane has six rays. Behind the smooth margin of the jaws, which is invested with dental substance, are some small conical teeth arranged irregularly. Since the jaws are undivided in the middle, these species ought in the arrangement of LINNÆUS to be referred to the genus *Diodon*, although he placed the species known to him under *Tetrodon*.

Sp. *Orthragoriscus mola* SCHN., *Tetrodon mola* L., WILLUGHB. Tab. I. 26, BLOCH *Icth.* Tab. 128, *Sun-fish*, DOMSMA, *Verhandel. van de Haarl. Maatsch.* XII. 1770, bl. 413—422, with a figure. The skeleton, heart, and intestinal canal are described and very beautifully figured in P. H. J. WELLENBERGH *Diss. inaug., Observ. anat. de Orthragorisco mola*, L. B. 1840, 4to. (From the bony pieces at the margin of the caudal fin in the specimen described by W., it has been imagined that it belongs to the genus *Ozodura* RANZANI; but at all events it is a different species from that described by R., as is proved not only by the different number of the fin-rays, but also by the form of the body, which in *Ozodura Orsini* is elongate.)

The genera *Ozodura, Trematopsis* and *Diplanchias* of RANZINI, as also the genera of the same writer founded upon the division of the under-jaw, or of both jaws, *Tympanium* and *Cephalus*, are unknown to me, but seem not to be sufficiently established, and, partly at least, to rest upon insecure or incorrect determinations. See RANZANI'S memoir in *Nov. comment. Acad. Scientiarum Bononiensis* 1839, of which TROSCHEL has given an epitome in ERICHSON'S *Archiv f. Naturgesch.* 1841, II. s. 140, 141.

Mola NARDO.

Sp. *Cephalus mola* RISSO, *Mola luna* NARDO.

Molacanthus SWAINS., *Pallasia* NARDO.

Sp. *Molacanthus Pallasii* SWAINS., *Diodon mola* PALL., *Spicil. Zool.* VIII. Tab. 4, fig. 7.

Diodon L. Maxillæ undivided. Body everywhere dotted with sharp spines. Dorsal fin small, remote, opposite to anal.

Urchin-fishes. They are able to inflate themselves by taking air into their spacious stomach, and then swim belly upwards. In addition they have a swimming-bladder divided into two lobes.

Compare on this genus CUVIER *Mém. du Mus.* IV. 1818, pp. 121—138, Tab. VI. VII. In some the spines are three-sided, or strongly carinate, as in *Diodon tigrinus* CUV. *R. Ani., éd. ill., Poiss.* Pl. III. fig. 3, from the E. Indian Sea, and in another from S. America; all of these are conjoined by LINNÆUS as *Diodon atringa* (doubtless a misprint for *Atinga*).

In addition there are species with long round quills, like those of the hedgehog, *Diodon hystrix* L., *Diodon punctatus* CUV., BLOCH *Ichth.* Tab. 126, from the Indian Ocean. Finally, there is a species with fine spines like needles, *Diodon pilosus* MITCHILL.

Triodon CUV. Upper jaw bipartite, lower entire. Body muricate with short spines. Pendulous sac beneath the body. (Olfactory organ perforate in front and behind.)

Sp. *Triodon bursarius* CUV., *Tetrodon bursarius* REINW., *Triodon macropterus* LESS. and GARN., *Voyage de* DUPERREY, *Poiss.* No. 4, CUV. *R. Ani., éd. ill.*, Pl. 112, fig. 1, from the E. Indian Sea. See CAM. DARESTE *Observations sur l'Osteologie du Poisson appelé Triodon macropterus. Ann. des Sc. nat.* 3e Série, *Zoolog.* Tom. XII. 1849, pp. 68—83, Pl. I. fig. 1.

Tetrodon L. Both jaws bipartite. Body muricate with short spines, especially below. (Olfactory organ representing in many a cirrus or tentacle.)

Four-tooth or *Spine-belly.* There are five rays in the branchial membrane. The head is usually short and blunt. The spines are very various; sometimes they are entirely absent on the back. The olfactory organ presents itself in many as a sulcated or fissured appendage in front of and above the eyes, *Tetrodon lineatus* L. In some it is a very small channel like the prick of a pin, with everted margin, as in *Tetrodon rostratus*, BLOCH *Ichth.* Tab. 146, fig. 2; in others a large, wide cavity, with folded margins, as in *Tetrodon grandispina*, a new species from Borneo in the Leyden Museum (*Chelonodon* MUELLER). Others have imperforate tentacula, in which the olfactory nerve is situated (*Arothon* MUELLER). Others, finally, would

seem to be entirely without nasal apertures or *tentacula* (*Anosmius* PETERS, MUELLER). To these differences in the olfactory organ J. MUELLER especially has directed attention (*Abh. der Akad. zu Berlin*, 1844, *Bau der Ganoiden*, s. 78, 79). The species are very numerous.

Sp. *Tetrodon lineatus* L., *Fahaca* HASSELQ., *Iter Palæst.* pp. 400—405, with a long brown stripe running longitudinally on the back and at the sides; white underneath. The spines are fine, and as though swollen at the point. This and some other species are supposed to be poisonous. (This species is quite different from *Tetrodon lineatus* BLOCH, *Faun. Japon., Pisc.* Tab. 125, figs. 1, 2.)

Many species occur in the sea of Japan, as *Tetrodon firmamentum* SCHL., *Faun. Jap., Pisc.* Tab. 120, fig. 2, *Tetr. rubripes* SCHL., *Faun. Jap., Pisc.* Tab. 123, fig. 1, &c.

Family XI. *Sclerodermi.* Snout conical or pyramidal. Mouth anterior, furnished with teeth. Body covered with hard scales, sometimes very small, or with a lorica composed of angular areolæ.

Balistes L. Body compressed, covered with scales or with a rough warty skin. Eight teeth in each jaw, broad, cuneate. Anterior dorsal fin made up of one or several spines, very near the head, or inserted into the head, posterior soft, opposite the anal.

Horned fishes. Although no ventral fins are present, there is a pelvis in all (see above, pp. 17, 18) of which the two bones have coalesced. Hence arises a bony keel on the abdomen below, connected forwards with the bones of the pectoral fins, behind with the bones that support the anal fin; see a figure in ROSENTHAL *Ichthyot. Tafeln*, Tab. XII. fig. 3.

In many the scales are very small, or their place is supplied by spine-like inequalities on the skin. Here belong the genera *Triacanthus*, *Alutera*, and *Monacanthus* of CUVIER. In others, which form the sub-genus *Balistes* CUV., very large rhomboidal scales are present; often there are found behind the branchial aperture some larger scales or pentagonal horny plates.

Many species have three or more parallel rows of horny spines on each side of the tail. Sp. *Balistes aculeatus* L., CUV. *R. Ani., éd. ill., Poiss.* Pl. 112, fig. 2;—*Bal. Conspicillum* SCHN., LAC. I. Pl. 15, fig. 2 (*Baliste americain*), *Faun. Japon., Pisc.* Tab. 129, fig. 1, a large species, black; the belly on each side with large pale yellow or dull white oval spots; from Japan;—*Bal. lineatus* BLOCH, SCHN., *Syst. Ichth.* Tab. 87, &c. In some species of *Monacanthus* CUV. the tail has a quantity of hard bristles on each side. Sp. *Bal. tomentosus* L., GRONOV. *Mus. Ichth.* Tab. VI. fig. 5.

See HOLLARD *Monographie des Balistides*, *Ann. des Sc. natur.* 3e Série, *Zool.*, Tom. XX. pp. 71—114, Pl. 13; 4ième Série, I. 1854; pp. 39—72, Pl. 2, 3; pp. 303—339, Pl. 5, II. pp. 321—366, Pl. 12—14; *suite et fin. Alutères*, Tom. IV. 1855, pp. 5—22, *Additions et Corrections*, pp. 23—27.

Ostracion L. Ten or twelve teeth in each jaw. Body trigonal or tetragonal, loricate, with scute inflexible, continuous, composed of hexagonal areolæ, perforate by apertures for the soft tail, the fins and the mouth. Branchial aperture linear.

Coffer-fish. The species of this genus are not very numerous, and all live in the tropical seas.

Sp. *Ostracion triqueter* L., BLOCH *Ichth.* Tab. 130, fig. 3, GUÉR. *Iconogr., Poiss.*, Pl. 66, fig. 3, CUV. *R. Ani., éd. ill., Poiss.* Pl. 112, fig. 2; from the West Indian sea;—*Ostracion cornutus* L., BLOCH *Ichth.* Tab. 133, *Faun. Japon., Pisc.* Tab. 131, fig. 4, from the East Indies and Japan, &c.

ORDER IX. *Malacopterygii.*

Branchiæ pectinate, with narrow laciniæ. Supra-maxillary bones not connate with intermaxillaries. Rays of fins articulate, except sometimes the first ray of the pectoral fins or of the dorsal fin.

Soft-finned. The rays of the fins are jointed and mostly split towards the point. This order corresponds in great part with that of the *Cyclolepidoti* of AGASSIZ, since the scales are usually without teeth at the posterior margin. Yet some of the *Malacopterygii* belong to the *Ctenolepidoti* of AGASSIZ, that is, they have toothed scales. The divisions of MUELLER, which are founded upon the swimming-bladder, we cannot here adopt, however highly we esteem the merits of this author in the anatomy and systematic arrangement of fishes. The presence of an air-tube or its absence and the consequent closure of the swimming-bladder, cannot supply a primary character for two divisions in which the swimming-bladder itself is often absent. Therefore we leave the *Physostomi* and *Anacanthini* of MUELLER in the same division together.

I. *Malacopterygii abdominales.* Swimming-bladder in most, almost always furnished with an air-duct. Ventral fins situated in the abdomen behind the pectoral, in a few absent.

We here join together the fishes usually regarded as *Malacopterygii abdominales*, although some of them have no ventral fins at all (*Pristigaster Gnathobolus*), whilst in others (*Notopterus* and *Chirocentrus*) they are very small. Similarly there are wingless insects amongst the *Diptera, Hemiptera*, &c.

Family XII. *Siluroidei.* Body covered with naked skin or loricate with large osseous scutes. Margin of upper jaw formed by

the intermaxillary bones, with supra-maxillary very small or changed into cirri. First ray of dorsal fin and of pectoral fins in most a spine, furnished with a moveable joint. Adipose fin behind the dorsal in many.

A. Mouth inferior, surrounded by a membranous cirrose velum.

Loricaria L. Body cuirassed. Teeth long, thin, recurved at the point, sometimes none. (Swimming-bladder none.) *Goniodontes* AGASSIZ.

Mailed fishes. These fishes live in the rivers of South America. The ribs are feebly developed and not numerous. The upper and lower spinous processes have, with the exception of those of some of the anterior vertebræ, coalesced to form a flat ridge compressed at the side.

Loricaria L. in part, LACEP. Dorsal fin single.

Loricaria AGASS. Branchiostegous membrane with four rays.

Sp. *Loricaria cataphracta* L., *Mus. Adolph. Frider.* Tab. 29, BLOCH *Syst. Ichth.* Tab. 34 (named *Loric. cirrhosæ*); the uppermost ray of the caudal fin runs out into a filament that equals the body in length;—*Loricaria maculata* BL., *Ichth.* Tab. 375, figs. 1, 2, GRONOV. *Mus. Ichth.*, Tab. II. *Plecostomus;* this species has the above filament scarcely as long as the caudal fin. In *Loricaria rostrata*, a new species in the *Rijks-Museum* at Leyden, the lowest as well as the uppermost ray of the caudal fin runs out into a filament. This species, from the *Caraccas*, is very narrow, with a pointed head. (The thus named species is not that of SPIX with the same name, but a new one afterwards figured by KNER as *Acestra acus.*)

See R. KNER *Die Panserwelse des Kaiserl. Konigl. Hof-naturalien Cabinettes zu Wieni* 1e Abth. *Loricaria,* Mit 8 Tafeln. (*Aus dem* VI. *Bd. der Denkschr. des Math. naturwiss. classe der Kaiserl. Akad. de Wissensch. besonders abgedruckt.*) R. KNER *Hypostomiden, Zweite Hauptgruppe der Familie der Panserwelse,* Mit 5 Tafeln. Wien, 1854. (*Aus dem* VII. *Bd. der Denkschriften,* &c.)

Rinelepis SPIX, AGASS. (and *Acanthicus* of the same) VALENC.

Branchiostegous membrane with three rays. Body aculeate or rough.

Hypostomus LAC. Dorsal fins two. Branchiostegous membrane with three rays.

Sp. *Hypostomus plecostomus* VALENC., *Loricaria plecostomus* L., GRONOV. *Mus. Ichth.* Tab. III. figs. 1, 2, LINN. *Mus. Ad. Frid.* Tab. 28, fig. 4.

Sisor HAM. BUCHAN. Body naked. Teeth none. First ray of caudal fin produced into a very long seta.

Sp. *Sisor rhabdophorus.* Is this its place? Compare on this fish F. HAMILTON BUCHANAN, *Account of the Fishes found in the Ganges*, Edinburgh, 1822, 4to. 207—209; J. E. GRAY, *Indian Zoology*, I. London, 1834, folio, Pl. 84, fig. 1.

B. Mouth terminal or sub-terminal, under the margin of upper jaw.

† Operculum immoveable.

Aspredo L., GRONOV. Body naked, head depressed, with eight or six cirri. Branchial aperture a small fissure. Teeth very small, setaceous, crowded, incurved. Eyes small, superior. Branchiostegous membrane with five rays. Dorsal fin single, small, nuchal; anal fin long. First ray of pectoral fins very strong, dentate.

Sp. *Aspredo lævis* VALENC., *Silurus Asprcdo* L., (*Syst. nat.*), *Amœn. Acad.* I. Tab. II. fig. v. p. 311, BLOCH *Ichth.* Tab. 372, fig. 1, GUÉRIN *Iconogr., Poiss.* Pl. 54, fig. 1, CUV. *R. Ani., éd. ill., Poiss.* Pl. 100, fig. 1, &c. Fresh-water fishes from Surinam. In many the belly is beset with little stems, to which small round bodies, like eggs, are sometimes attached.

†† Operculum moveable. (*Silurus* L. in part.)

Siluroids proper.—The cranium has in the mid plane an oblong aperture or fontanelle in front of the frontal bone between it and the æthmoid, and usually another further back between the frontal bone and the interparietal. The teeth are mostly small, card-shaped, and very numerous, placed close together. The *suboperculum* is wanting, and thus the gill-cover consists of three pieces only. The number of branchial rays is very various, but the two hindmost, especially the last, are sometimes much broader than the rest, and supply the place in some degree of the *suboperculum.* The first ray of the pectoral fin is in many thick and bony, and is so affixed to an angular articular cavity of the humerus, that the extended ray can be rendered immoveable as by a bolt. Mostly a large, strong, cordiform swimming-bladder is present; there are no blind appendages at the inferior aperture of the stomach.

Many of these fishes live in fresh-water, some as well in rivers as in the sea; but numerous also are the species which, especially in warm regions, must be regarded as marine, the species of *Arius* and *Plotosus* in the East Indies, &c.

Brachystacus nob. Head depressed, broad; eyes small, superior. Mouth transverse, with gape large. Teeth thin, crowded in the jaws; palate edentulous. Branchiostegous membrane with seven rays. Dorsal fins two, the anterior near the head, with first ray strong, short; the posterior depressed, confluent with caudal, and with a second anal at the apex of tail; the anterior anal fin separate from the terminal fin.

Sp. *Brachystacus chaca, Platystacus chaca* BUCHAN., *Chaca lophioides* VALENC., HAMILTON BUCHANAN *Account of the Fishes found in the Ganges*, Pl. 28, fig. 43, VALENCIENNES *Hist. nat. des Poiss.* XV. Pl. 451; 9″ long; found by BUCHANAN in Bengal. The *Rijks-Museum* at Leyden possesses also specimens of this singular fish from Borneo. The colour is blackish.

Callichthys L. (previously, species of *Silurus Syst. nat.* ed. 12, *Cataphractus* LAC., SWAINS. and *Hoplisoma* SWAINS.). Body loricate at the sides, with a double row of scutes, naked below. Mouth small, with teeth very small. Cirri four. Branchiostegous membrane with five rays. Dorsal fins two, the second adipose, with single ray.

Sp. *Callicthys asper* VAL., *Silurus callicthys* L., *Tamoata* MARCGRAVI, *Hist. nat. Brasil.* 1648, p. 151, BLOCH *Ichth.* Tab. 377;—*Call. longifilis* VALENC., GUÉRIN *Iconogr., Poiss.* Pl. 53, fig. 4. Fresh-water fishes from S. America; they have no swimming-bladder.

Doras LAC., *Mystus* SWAINSON. Head mailed. Body at the lateral line armed with a single row of carinate or aculeate scutes, elsewhere naked. Teeth crowded, small, in both jaws, or in lower alone. Cirri six. Branchiostegous membrane with 6—8 rays. Dorsal fins two, second adipose. Bone of humerus ending in a spine above the pectoral fin.

Sp. *Doras carinatus* VAL., *Silurus carinatus* L., CUV. et VALENC. *Hist. des Poiss.* XV. Tab. 442; *Doras costatus* LAC., *Silurus costatus* L., GRONOV. *Mus.* II. Tab. V. figs. 1, 2, BLOCH *Ichth.* Tab. 376, &c. Fresh-water fishes from S. America.

Synodontis CUV. Head mailed. Body naked. Teeth small, conical in upper jaw; teeth of lower jaw compressed, thin, mobile, recumbent, with incurved ascending apex. Cirri six; the four inferior pinnate or ramose. Branchiostegous membrane with seven rays. Dorsal fins two, the second adipose. Bone of humerus ending posteriorly in a spine. First ray of pectoral fins very strong, dentate.

Sp. *Synodontis macrodon* ISID. GEOFFR. SAINT-HILAIRE, *Silurus Clarias* HASSELQUIST;—*Synod. arabi* VALENC., *Silurus schal* BLOCH, *Syst. Ichth.*, SONNINI *Voyage en Egypte*, Pl. 21, fig. 2;—*Synod. serratus* RUEPPELL, *Beschr. und Abbild. neuer Fische im Nil entdeckt*, 4to. 1829, Tab. II.—*Synod. maculosus* RUEPPELL, *ibid.* Tab. III. fig. 1.

All the known species are found in the Nile.

Pimelodus VALENC. (species of *Pimelodus* LACÉP.). Body naked. Teeth in maxillæ very thin, crowded, sometimes none; palate edentulous. Branchiostegous membrane mostly with eight rays (5—12). Dorsal fins two, the second adipose, frequently small, placed above the anal. Cirri six or eight.

Sp. *Pimelodus Sebæ* CUV., *Silurus clarias* L., excl. synon., SEBA *Thesaur.* III. Tab. 29, fig. 1; *Pimelodus catus* CUV., *Silurus catus* L., CUV. et VALENC. *Poiss.* XV. Pl. 432, &c.

The species of this genus are very numerous in warm regions, especially in the western hemisphere.

Calophysus MUELL. and TROSCH.[1]

Hypophthalmus SPIX (in part), VALENC. Teeth none. Eyes placed at the inferior margin of jaw. Branchiostegous membrane with fourteen or fifteen rays.

Sp. *Hypophthalmus marginatus* VALENC., CUV. et VALENC. *Hist. nat. des Poiss.* XV. Pl. 439;—*Hypophth. Spixii* VAL., *Hypophthalmus edentatus* SPIX, &c.

Ageneiosus LACEP., VALENC.

Ketengus BLEEKER. Genus unknown to me, with four cirri[2].

Arges VALENC. Teeth bifid at the apex. Branchiostegous membrane with four rays. Eyes small. Cirri two.

Sp. *Arges Sabalo* VAL., *Hist. nat. des Poiss.* Pl. 444, Peru.

To this genus VALENCIENNES refers the small species of fish which HUMBOLDT has described under the name of *Pimelodus cyclopum*, and which lives in brooks in the high ranges of Quito. It resides also in subterranean lakes, which appear to communicate with the volcanos of these regions, at least if, as the natives assert, it is the same species which is ejected with mud from the *Cotopaxi* sometimes by thousands. HUMB. *Recueil d'Observations de Zoologie et d'Anat. compar.* I. pp. 21—25, Pl. 7.

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[1] Compare MUELLER and TROSCHEL *Horæ Ichthyologicæ*, 3, 1849, pp. 1, 2.

[2] P. BLEEKER, *Nieuwe Bijdrage tot de Kennis der Siluroieden von Java.* Batavia, 1846, p. 9.

Brontes VALENC.

Distinguished from the preceding genus by the absence of a second dorsal fin. Sp. *Brontes prenadilla* VALENC. l. l. Pl. 445; this fish also lives at great heights in brooks that flow from the *Cotopaxi*, and is also, as is reported, ejected by the Volcano.

Astroblepus HUMB., VALENC. Dorsal fin single, radiate. Ventral fins none.

Sp. *Astroblepus Grixalvii* HUMB., *Recueil d'Observ.* I. pp. 19, 20.

Trachelyopterus VALENC.

Auchenipterus VALENC.

Bagrus CUV. (with the addition of some species of *Pimelodus* ejusd.). Body naked. Teeth setaceous, crowded in jaws; palatine teeth in some arranged in the vomer in a parallel row, similar to the maxillary, in others at the sides of mouth in the bones of palate and the pterygoids, sometimes globose. Branchiostegous membrane with rays various in number, mostly 6—10. Dorsal fins two, the second adipose. Cirri 2—8.

Arius VALENC. Palatine teeth arranged in two lateral groups. Branchiostegous membrane with 5—8 rays.

Sp. *Arius militaris* VALENC., *Silurus militaris* L.? CUV. et VALENC. *Hist. des Poiss.* XV. Pl. 430. Two stiff bony cirri at the upper jaw. BLEEKER has discovered some new species of this division which he unites under the generic name of *Osteogeneiosus*. In the remaining species the *cirri* are membranous and flexible; many of these species occur in America, others in the East Indies, as *Arius rita* VALENC. l. l. Pl. 429.

Bagrus CUV. Palatine teeth crowded in a continuous parallel row behind the teeth of upper jaw.

Silundia VALENC. Two small cirri. Adipose fin small, anal long. Branchiostegous membrane with 12 rays.

Pangasius VALENC. Cirri 4. Branchiostegous membrane with 10 rays.

Galeichthys VALENC. Head rotundate. Branchiostegous membrane with 6 rays. Cirri 6 or 4.

Platystoma AGASSIZ. Snout depressed. Branchiostegous membrane with 16 or 17 rays. Cirri 6.

Phractocephalus AGASS. Branchiostegous membrane with 9 rays. Cirri 6. Osseous rays imperfect in the upper margin of adipose fin.

Bagrus VALENC. Branchiostegous membrane with 8—10 rays. Cirri 6 or 8. Adipose fin without rays.

Sp. *Bagrus Bajad* VALENC., *Silurus Bajad* FORSK. and GMEL., *Description de l'Egypte, Poiss.* Pl. 15, fig. 1, GUÉRIN *Iconogr., Poiss.* Pl. 52, 53, fig. 1. *Bagrus Schilbeides* VALENC., *Hypopthalmus niloticus* RÜPPELL, *Beschr. u. Abb. neuer Fische im Nil,* Tab. 1. fig. 1, &c. See section of the skull in OWEN *Homologies,* &c. Pl. 1. fig. 3.

The species of the sub-genus *Bagrus* are chiefly from the eastern hemisphere, and are particularly numerous in Asia; also those of the subdivisions *Silundra* and *Pangasius,* are from the E. Indies. On the other hand, the species of *Galeichthys, Platystoma,* and *Phractocephalus* are from the western hemisphere, principally from Brazil[1].

Silurus CUV. Body naked. Teeth crowded, setaceous in maxillæ; a row of teeth in palate, parallel to the maxillary teeth. Dorsal fin single, short, rather near the head. Anal fin long. Cirri six or four. Branchiostegous membrane with 10—19 rays.

Schilbe CUV., VAL. First ray of dorsal fin spinose, thick, dentate.

Sp. *Silurus mystus* L., *Descr. de l'Egypte, Poiss.* Pl. 11, fig. 3, GUÉRIN *Icon., Poiss.* Pl. 51, fig. 2, &c.

Silurus CUV., VAL. Dorsal fin unarmed.

Sp. *Silurus glanis* L., BLOCH *Ichth.,* Tab. 34, CUV. *R. Ani., éd. ill., Poiss.* Pl. 96, fig. 1, BRANDT u. RATZEBURG, *Mediz. Zool.* II. Tab. V. fig. 2, the *sheat-fish;* six cirri, two on the upper jaw, very long, four below the underjaw; anal fin long and coalescing behind with the caudal fin; is often more than four feet long, and after the sturgeon is the largest fresh-water fish of Europe, where it occurs especially in the eastern parts, as also in some regions of Asia. In Holland the fish is found only in the Haarlem meer, with the draining of which it will disappear from the catalogue of our native fishes. A figure of the skeleton is found in ROSENTHAL *Ichth. Tafeln,* IX. figs. 1—7, and in BRANDT u. RATZEBURG l. l. Tab. VI.

Cetopsis AGASS. Dorsal and pectoral fins unarmed. Eyes very small, covered by skin. Branchiostegous membrane with nine rays.

Sp. *Cetopsis cœcutiens* AGASS.;—*Cet. Candiru* AGASS. Brazil.

Saccobranchus VALENC., *Heteropneustes* MUELL. Body naked. Teeth crowded, setaceous in maxillæ and in vomer. Dorsal fin single, small, unarmed, situated above the pectorals. First ray of pectoral fins osseous, denticulate. Anal fin long, extending almost as far as caudal. Rays of branchiostegous membrane seven. Cirri eight. Two lateral sacs at the back below the muscles, resting on the vertebræ, connected with the branchial cavity.

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[1] Compare MUELLER and TROSCHEL, *Hor. Ichth.* pp. 6—11, where also some other sub-genera are announced.

Sp. *Saccobranchus fossilis, Silurus fossilis* BLOCH, *Ichth.* Tab. 370, fig. 2; H. BUCHANAN, *Fishes of the Ganges*, Pl. 37, fig. 46; in Bengal. The singular, elongated air-sacs receive a branch from the branchial arteries, and their veins go to the *aorta*; consequently they are respiratory organs supplementary to the gills; see J. TAYLOR, *Edinburgh Journal of Science*, v. 1834.

Clarias GRONOV., VALENC., *Macropteronotus* LACEP., *Heterobranchus* GEOFFR. Head mailed. Body naked. Teeth very thin, crowded in both jaws and in vomer. Branchiostegous membrane, with 9—15 rays. Dorsal fins two, the second adipose, or a single, long fin, supported by rays. Cirri eight or six. Arborescent appendages, adhering to the third and fourth branchial arch.

a) *Dorsal fin single; with* 8 *cirri. Clarias* GRONOV., VALENC.

Sp. *Clarias Hasselquisti* VALENC., *Silurus anguillaris* L. (excl. synon.), SONNINI *Voyage en Egypte*, Pl. 22, fig. 2, CUV. *R. Ani., éd. ill., Poiss.* Pl. 101, fig. 2 (the branchial appendages fig. 2a, 2b.)—*Charmuth* HASSELQUIST, *It. Palæstin.*, p. 371, *Karmouth* SONNINI; in the Nile;—*Clarias marpus* VALENC., GRONOV. *Zoophylac.* Tab. 8, fig. 3—5, &c.

b) *Dorsal fins* 2; *with* 6 *cirri. Heterobranchus* VALENC.

Sp. *Heterobranchus Geoffroyi* VALENC., *Heterobranchus bidorsalis* GEOFFR., &c.

Plotosus LACEP. Head and body naked. Teeth conical, crowded in maxillæ, globose or rotundate in vomer. Branchiostegous membrane with ten or eleven rays. Dorsal fins two, supported by rays, second elongate, confluent at the acuminate apex of tail with the caudal and anal. First ray of dorsal fin and of pectoral fins dentate.

Sp. *Plotosus lineatus* VALENC., LACEP. *Poiss.* v. Pl. 3, fig. 2, *Platystacus anguillaris* BLOCH *Ichth.* Tab. 373, figs. 1, 2, *Syst. Ichth.* Tab. 74?—*Plotosus albilabris* VALENC., GUÉRIN *Iconogr., Poiss.* Pl. 53, fig. 3, &c.

Malapterurus LACEP. Head and body naked. Teeth small, congested into a crescentic row in each maxilla. Branchiostegous membrane with 7—8 rays. Dorsal fin single, adipose, remote. Pectoral fin unarmed.

Ailia GRAY, VALENC. Ventral fins approaching the pectoral, subthoracic. Anal fin long. Body compressed. Eight long cirri.

Sp. *Malapterus* (sic) *Ailia Bengalensis* GRAY, *Indian Zoology*, Pl. 85, fig. 2.

Malapterurus LAC., VALENC. Ventral fins remote. Anal fin short. Body round. Six short cirri.

Sp. *Malapterurus electricus* LAC., *Silurus electricus* GMEL., *Encycl. méth., Poiss.* Pl. 62, fig. 245, (copied from a figure of BROUSSONET; see his memoir, *Mém. de l'Acad. royale des Sc. de Paris*, 1782, pp. 692 and following), CUV. *R. Ani., éd. ill., Poiss.* Pl. 99; *le trembleur;* this fish lives in the Nile and other rivers of Africa, in the Senegal, and even to the 19th deg. south lat. in the Zambeze. Like the *Torpedo* and *Gymnotus electricus* it can give shocks, concerning which ADANSON, FORSKÅL, and BROUSSONET have imparted observations. The electric organ lies below the integument on each side of the body, between two tendinous membranes formed of crossed filaments, of which the innermost covers a layer of loose conjunctive tissue, which has been regarded as a second or internal electric organ. The proper electric organ is thickest at the abdomen, gelatinous, transparent, and consists of many cells, visible to the naked eye, mostly rhomboidal; it receives its nerves from the *nervus vagus*. See GEOFFROY SAINT-HILAIRE *Ann. du Mus.* I. pp. 401—403, Pl. 26, fig. 4; RUDOLPHI, *Abhandl. der Akad. der Wissensch. zu Berlin*, aus d. Jahre 1824, s. 137—144, Taf. I.—IV.; J. MUELL. *Handb. der Physiol.* I. 3tte Aufl. 1838, s. 66; VALENCIENNES *Archives du Muséum d'Hist. nat.* II. 1841, s. 43—61, Pl. IV.; W. PETER'S in MUELLER'S *Archiv*, 1845, s. 375—377, Taf. 13, figs. 8—11. This fish is also eaten and noted for its flavour; it attains a length of one to two feet.

Trichomycterus (HUMBOLDT) nob. Body naked, round, compressed towards the tail. Fins unarmed. Dorsal fin single, supported by rays. Teeth small, setaceous, crowded in jaws; palate edentulous. Branchiostegous membrane with eight rays. Cirri six, two filiform in front of nostrils, two conical maxillary at both sides of mouth.

Trichomycterus VALENC. Ventral fins.

Sp. *Trychomycterus punctulatus* VALENC., *Hist. nat. des Poiss.* XVIII. Pl. 553, &c. Fresh-water fishes from South America, which form the transition to the genus *Cobitis*. They have, like the following genus, no swimming-bladder.

Eremophilus HUMB., VALENC. No ventral fins.

Sp. *Eremophilus Mutisii* HUMBOLDT, *Observ. de Zool.* I. pp. 17—19, Pl. VI., VALENCIENNES, l. l. Pl. 553, in fresh-water on the high table-land of Bogota. VON HUMBOLDT had already proposed for this fish the name *Trichomycterus*, which VALENCIENNES has given to the species, discovered at a later period, which have ventral fins.

Family XIII. *Cyprinoidei.* Body almost always covered with rounded scales. Dorsal fin single, radiate. Mouth small, edentulous, in many cirrose. Branchiostegous membrane with three rays. Inferior pharyngeal bones armed with large teeth. Swimming-

bladder connected with the labyrinth by a set of ossicles, constricted in the middle or divided into an anterior and a posterior.

a) No scales.

Aulopyge HECKEL. (Cirri four, moderate. Uro-genital aperture and vent in females at the apex of a fleshy process connate with the anterior part of the anal fin.)

Sp. *Aulopyge Hügelii* HECKEL, *Abbildungen und Beschreibungen der Fische Syriens*, Stuttgart, 1843, 8vo. (*aus* RUSSEGGER'S *Reisen abgedruckt*) s. 31; Dalmatia and Bosnia.

This fish, which I have not seen, is regarded by HECKEL as a form intermediate between *Cobitis barbatula* and *Cyprinus Barbus*.

b) Body scaly.

Cobitis L. (excl. of some species). Body scarcely narrowed at the tail, elongate, covered with small scales, mucose. Mouth edentulous, guarded with (6—10) cirri. Fins all unarmed, ventral remote, placed under the dorsal fin.

Mud-creeper. The swimming-bladder in most lies in a bony cavity, which is attached to the third vertebra (see WEBER, *de Aure animal. aquatilium*, pp. 63, 64, Tab. VI., ROSENTHAL *Ichthyot. Tafeln*, Taf. X. fig. 8, OWEN *Homol.* &c. Pl. I. fig. 7). LINNÆUS in his genus *Cobitis* counted three species which belong here. (*Cobitis Anableps* and *Cob. heteroclita* L. must be referred to other genera.) These three species are: *Cobitis barbatula* L. (FRIES, EKSTROEM *och* SUNDEVALL, *Skandinaviens Fiskar*, Tab. 53), *Cob. tænia* L., and *Cob. fossilis*, all European; but subsequently many species of this genus have been discovered in different parts of Asia. They are all fresh-water fishes, of which few surpass 6″ in length. *Cobitis fossilis* L. (BLOCH *Ichth.* Tab. 31, fig. 1), comes to the surface of the water when the weather is changing, and is very tenacious of life; this fish gulps in air, abstracts from it the oxygen, and gives out carbonic acid gas by the vent[1]. In these species the caudal fin is roundish, but there are also exotic species with a forked caudal fin (*Schistura* MACCLELLAND). In a species from Syria, described by VALENCIENNES under the name of *Cobitis malapterura*, there is a fold of skin on the back like the rudiment of a second dorsal or adipose fin, which recalls the preceding family. Compare however HECKEL, who attaches little importance to the fold. *Fische Syriens*, p. 151.

See CZERNAY *Notice sur le Cobitis merga* KRYNICKII, *Bulletin de la Soc. Imp. des natur. de Moscou*, I. pp. 548. 549, Tab. VIII. fig. 1.

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[1] See on this intestinal respiration ERMAN in GIBERT'S *Annalen*, Bd. XXX. 1808, s. 140—159.

Homaloptera VAN HASSELT, *Balitora* GRAY. Body elongate, covered with small scales, partly naked beneath. Mouth inferior, small, with six cirri. Eyes small, placed in upper part of head. Pectoral fins large, flattened. Dorsal fins placed above the ventral.

Sp. *Homaloptera ocellata* V. HASS. (fig. in the first edition of this *Handbook*, Pl. 13, fig. 12);—*Homaloptera erythrorhina* V. HASS., VALENC. *Hist. nat. des Poiss.* XVIII. Pl. 524, from Java. This genus, as it seems, is intermediate between *Cobitis* and *Cyprinus*. The caudal fin is forked, and not truncated, as in most of the species of *Cobitis*. According to VALENCIENNES the swimming-bladder is wanting.

Cyprinus L. Head naked, with mouth small, edentulous. Teeth of inferior pharyngeal bones large; a hard lamina below the occiput, in place of the superior pharyngeals. Branchiostegous membrane with flat, broad rays.

Carp; a large genus or a natural group of sub-genera in which all the species admitted by LINNÆUS may be left, with the exception of *Cyprinus dentex* (*Salmo dentex* HASSELQ.) and *Gonorhynchus* GRONOV. There will then remain twenty-nine species which were known to LINNÆUS, whilst now more than 400 species are known[1]. In some the dorsal and anal fins, or the first alone, are furnished with a hard and dentate ray; in others all the rays are soft. In some the dorsal fin is very long, in others, on the other hand, the anal fin; in many both these unpaired fins are short. Some have four or two barbules (*cirri*) at the mouth. On these characters, to which were afterwards added those which are supplied by the different disposition of the teeth of the *ossa pharyngealia* (AGASSIZ, HECKEL), depends the division of the groups which must in our opinion be regarded as sub-genera alone, not as *genera*.

These fishes live in fresh-water, and live principally on seeds and plants, yet also on insects, worms, &c. Most of them are found in Asia and Europe; many species are indigenous.

Compare on this genus amongst others N. G. LESKE, *Ichthyologiæ Lipsiensis Specimen*, Lipsiæ 1774, 8vo; AGASSIZ *Distribution des genres des Cyprins, Mém. de la Soc. des Sc. natur. de Neufchatel*, 1836, Tom. I. p. 33, and foll. (WIEGMANN'S *Archiv f. Naturg.* 1838, s. 73—82); J. HECKEL, *Ueber einige neue Cyprinen, nebst einer systematischen Darstellung der Europ. Gattungen dieser Gruppe, Ann. des Wiener-Museums*, I. 1836, s. 219—234,

[1] L. C. BONAPARTE reckons the number even at 650, for which the grounds are unknown to me.

Taf. 19—21; and *Fische Syriens*, s. 11—53, &c., Tab. I. (figures of the pharyngeal teeth).

† *Dorsal fin long* (i. e. *beginning above the ventral fins and produced as far as the posterior part of the anal fin*).

Cyprinus Cuv. A dentate spine in the anterior part of the dorsal and the anal fins. Anal fin short. Pharyngeal teeth masticatory, with crown mostly sulcate.

Sp. *Cyprinus carpio* L., Bloch *Ichth.* Tab. 16, Yarr. *Brit. Fishes*, I. p. 305. Cuv. *R. Ani., éd. ill., Poiss.* Pl. 93, fig. 1; *the Carp, la Carpe, der Karpfen*; four short barbules at the upper jaw, the back round, olive-coloured, belly yellow; in still waters, especially in the south of Europe; this species may be 3′ long. A variety with very large scales and naked spots is named *Spiegelkarper, Carpe à miroir*, Bloch *Ichth.* Tab. 17. Monstrous individuals sometimes occur with an arched head and short impressed snout.

In others there are no barbules. They form the genus *Carassius* Nilsson, *Cyprinopsis* Fitzinger. Sp. *Cyprinus carassius* L., Bloch *Ichth.* Tab. 11, *Skandinaviens Fiskar*, Tab. 31; the *steenkarper, stone-carp*, with a very deep body, is seldom more than 1′ long. *C. Gibelio* Bloch, Gmel., which is less deep and more elongate, ought, according to Eckstroem, to be regarded simply as a variety of this species.

Cyprinus auratus L., Bloch *Ichth.* Tab. 93; the *gold-fish* (*Kin-Yu*), from China and Japan, naturalised in our stews; it was first imported into Holland in the middle of the last century (see Baster *Verhand. van de Haarl. Maatsch.* VII. bl. 215—246, *Natuurk. Uitsp.* II. bl. 83—101, Tab. XI.); according to Bloch it was introduced into England in 1611, in the reign of James I. The varieties of this fish are very numerous, there are also modifications of the fins; some have no dorsal fin.

Gibelion Heckel. Dorsal and anal fin without osseous ray. Anal fin short.

Sp. *Cyprinus abramoides* Sykes, *Trans. of the Zool. Soc.* II. Part 5, Pl. 61, fig. 2; from India, like the other species of this division.

Rhodeus Agars. Dorsal and anal fin elongate. Anal fin without osseous ray.

Sp. *Cyprinus amarus* Bloch, Tab. 8, fig. 3, &c. (Add genus *Devario* Heck.)

†† *Dorsal fin short.*

a) *Anal fin shorter than, or equalling dorsal.*

Barbus Cuv. Osseous ray in dorsal fin, and sometimes in anal fin. Cirri four. Dorsal fin placed above the ventral. Pharyngeal teeth cylindrical, uncinate towards the apex, hollowed by an oval fossa before the apex.

Sp. *Cyprinus barbus* L., BLOCH *Ichth.* Tab. 18; the *barbel*, &c.

NOTE.—Add genera *Systomus* MACCLELL., *Labeobarbus* RUEPP., *Luciobarbus* HECK., *Schizothorax* HECK., *Scaphiodon* HECK.

Catostomus LESUEUR (and *Rhytidostomus* HECK.).

Labeo CUV. Dorsal fin high, beginning in front of ventral fins. No osseous ray. Mouth with thick fleshy lips, with two cirri, sometimes with none. Pharyngeal teeth compressed, aggregate, with crown obliquely truncate.

Sp. *Cyprinus niloticus* FORSK., GMEL., CUV. et VALENC. *Poiss.* XVI. Pl. 485, GUÉRIN *Iconogr., Poiss.* Pl. 46, fig. 3;—*Cypr. Forskalii*, *Labeo Forskalii* RUEPPELL, *Mus. Senckenb.* II. Taf. III. fig. 1, described by FORSKÅL as a variety of the preceding, &c.

Cyrene HECK., *Dangila* VALENC.

Rohita VALENC.

Tylognathus HECK.

Discognathus HECK.

Gobio CUV. Dorsal and anal fins without osseous ray. Head flat above. Mouth with two cirri. Pharyngeal teeth uncinate.

Sp. *Cyprinus gobio* L., *Gobio fluviatilis* CUV., BLOCH *Ichth.* Tab. 8, fig. 2, CUV. et VAL. *Poiss.* XVI. Pl. 481; the *gudgeon*, &c.

Isocephalus HECK. (*Cirrhina* CUV. VAL., with the addition of some other species from the East Indies).

Tinca CUV. Dorsal and anal fins without osseous ray. Dorsal fin inserted behind the commencement of ventral fins. Pharyngeal teeth compressed, clavate. Scales minute, covered with mucus. Two small cirri.

Sp. *Cyprinus tinca* L., BLOCH *Ichth.* Tab. 14, *Skandinav. Fiskar*, Tab. 52, CUV. *R. Ani., éd. ill., Poiss.* Pl. 94, fig. 1; the *tench*, greenish, with 10 rays in the anal fin; this fish seldom attains more than 1′ of length, occurs nearly in the whole of Europe, but is rare in the north, and probably is not met with in higher latitudes than 60 deg. N.

Chondrostomus AGASS. Dorsal and anal fins without osseous ray. Cirri none. Mouth inferior, with margin attenuated into a cartilaginous edge. Pharyngeal teeth masticatory, compressed, with narrow oval crown.

Sp. *Cyprinus nasus*, L., BLOCH *Ichth.* Tab. 3, &c.

Add genera *Gymnostomus*, *Chondrochylus*, and *Chondrorhynchus* HECK.

Leuciscus KLEIN, CUV. Dorsal and anal fins without osseous ray. Mouth anterior or superior, with soft lips. Pharyngeal teeth uncinate. Abdomen behind ventral fins more or less carinate. Cirri mostly none, more rarely two or four.

Sp. *Cyprinus erythrophthalmus* L., BLOCH *Ichth.* Tab. 1, *Skandinaviens Fiskar*, Pl. 16; the *red-eye* or *rud*;—*Cyprinus rutilus* L., BLOCH *Ichth.* Tab. 2, *Skand. Fiskar*, Pl. 15, the *roach*, &c.

A very numerous sub-genus; the scales are generally of moderate size; they are small in *Phacinus* AGASS.

Here belong the genera *Squalius* and *Scardinius* BONAP., *Idus*, *Leuciscus*, *Phoxinellus*, *Argyreus*, and *Leucosomus* of HECKEL and *Opsarius* of MACCLELLAND (in part).

b) *Anal fin longer than dorsal.*

* *Mouth superior; lower jaw ascending at the apex.*

Aspius AGASSIZ (*Aspius* and *Alburnus* HECK.) Dorsal and anal fins without osseous ray. Cirri none. Body subcompressed, rotundate beneath. Pharyngeal teeth uncinate. Dorsal fin placed above the space between the ventral fins and the anal fin.

Sp. *Cyprinus alburnus* L., BLOCH *Ichth.* Tab. 8, fig. 4, *Skandin. Fiskar*, Pl. 51; the *bleak*, &c.

Chela CUV. (*Pelecus* AGASS.). Dorsal and anal fins without osseous ray. Cirri sometimes four or two, mostly none. Body carinate beneath, compressed or cultrate. Pharyngeal teeth uncinate. Dorsal fin remote, placed over anal.

Sp. *Cyprinus cultratus* L., *Leuciscus cultratus* VALENC., BLOCH *Ichth.* Tab. 37, in Russia, &c. Here are arranged some species from India. The genus *Nuria* of VALENCIENNES is characterised by the presence of two or four long barbules.

** *Mouth anterior.* (Cirri none).

α) *Dorsal and anal fins without osseous ray.*

Abramis CUV. (*Blicca*, *Bliccopsis*, *Abramis*, *Ballerus* HECK.).

Sp. *Cyprinus Brama* L., BLOCH *Ichth.* Tab. 13, *Skandin. Fiskar*, Pl. 41; the *bream*, *la brème*; high; the long anal fin has 28 to 29 rays. This fish attains a length of more than 1'.

β) *Dorsal fin with osseous ray.*

Sub-genera: *Acanthobrama*, *Osteobrama*, *Glossodon* HECKEL.

Family XIV. *Cyprinodontes.* Teeth small in maxillæ. Superior and inferior pharyngeal teeth conical or subulate, crowded. Superior margin of mouth formed by the intermaxillary bone. Rays of branchiostegous membrane 5—6. Adipose fin none. Head, opercula and cheeks covered with scales?

[Swimming-bladder simple. Pyloric appendages none. Small fishes, or of moderate size, with scales often large; many are viviparous.]

This small family is distinguished from the preceding, with which it agrees in *habitus*, by the teeth and by the gill-membrane with more than three rays, and was first separated from it by AGASSIZ. Most of the species are found in America. Some however occur in Europe, in Syria and Egypt.

Anableps ARTEDI, BL. (species of Cobitis L.). Teeth slender, subulate in both jaws, palate edentulous. Eyes protuberant; cornea divided transversely into two segments. Head depressed between the eyes. Nostrils produced into a tubular papilla. Branchiostegous membrane with five rays. Pectoral fins scaly. Dorsal fin small, remote, placed behind the anal; anal fin in males adhering to the posterior margin of a conical scaly process.

Peeper aloft.—The eye of these fishes reminds us of the form of this organ in the insect genus *Ascalaphus.* (See Vol. I. p. 420.) The cornea is divided into two halves by an opaque transverse band; the *iris* also appears to be double, and thus to form a double pupil, yet in reality is merely drawn together by two processes from the iris, that meet under the transverse band of the cornea. The connexion between the seemingly two pupils is quite apparent, particularly in young fishes. The lens is pear-shaped, and the broader portion lies under the upper and larger segment of the cornea. The other parts of the eye offer nothing peculiar. The structure of these eyes has been described by ARTEDI, CAMPER, LACEPÈDE, BLOCH, J. F. MECKEL (*Archiv f. die Physiol.* IV. 1818, s. 124, 125), and circumstantially by D. W. SŒMMERING especially (*De oculorum sectione horiz.* Gottingæ, 1818, pp. 68, 69, with a figure), and by VALENCIENNES (*Hist. nat. des Poiss.* XVIII. pp. 264, 266, Pl. 539).

These fishes, of which for a long time only one species was formed, are found in Surinam; they are viviparous.

Sp. *Anableps tetrophthalmus* BLOCH, *Cobitis Anableps* L., *Anableps Gronovii* VALENC., GRONOV. *Zoophyl.* Tab. I. figs. 1—3, BLOCH *Ichth.* Tab. 361, *Syst. Ichth.* Tab. 71, CUV. *et* VALENC. *Poiss.* XVIII. Pl. 538. The skeleton is figured by ROSENTHAL *Ichthyot. Tafeln,* Tab. X. figs. 9, 10. Two other species are noted and figured by VALENCIENNES *op. cit.* Pl. 540, 541.

Cyprinodon LAC. Head depressed; intermaxillary bone protractile. Teeth in maxillæ small. Branchiostegous membrane with five rays, more rarely six. Body compressed.

a) *Branchiostegous membrane with 5 rays.*

Pœcilia BL., VAL. Teeth in maxillæ mobile, incurved, in a single row; teeth crowded and very thin behind this row.

Sp. *Pœcilia surinamensis* VALENC., CUV. *R. Ani., éd. ill., Poiss.* Pl. 95, fig. 1; compare DUVERNAY, see above, p. 42, &c.

Mollienisia LESUEUR. Sp. *Mollienisia latipinna* LES., CUV. l. l. fig. 4; this species from North America is distinguished by a very long dorsal fin (of 14 rays) and by the position of the ventral fins close behind the pectorals.

Cyprinodon LAC., *Lebias* CUV. Maxillary teeth in a single row, tripartite at the apex.

Sp. *Cyprinodon calaritanus* VAL., *Lebias calaritana* BONELLI, &c.

Fundulus LAC. Maxillary teeth very thin, crowded.

Sp. *Fundulus cœnicolus* VAL., *Cobitis heteroclita* L., CUV. et VAL. *Poiss.* 18, Pl. 580, &c. All the species of this sub-genus are from America.

b) *Branchiostegous membrane with 6 rays.*

Hydrargyra LAC. (*Cyprinodon* VAL. previously). Maxillary teeth very thin, crowded.

Sp. *Hydrargyra swampina* LAC.;—*Hydrarg. hispanica* VAL., *Poiss.* Pl. 531, fig. 1.

Orestias VALENC. Teeth in maxillæ conical, thin, crowded. Branchiostegous membrane with five rays. Dorsal fin remote, opposite to anal. Ventral fins none.

Sp. *Orestias Cuvierii* VALENC., l. l. Pl. 352; from the lake *Titicaca;* the largest species of the genus becoming 8 or 9 inches long. Most of the other species of *Orestias* and *Cyprinoden* are under 3". The eyes are mostly large. In small species of this and the preceding genus the cranial bones are very thin, and so transparent that the brain is seen lying within the cranium.

Family XV. *Characini.* Body covered with scales distinct, regular, imbricated. Dorsal fins mostly two, the posterior adipose. Superior margin of mouth formed in the middle by the intermaxillary bone, at the sides by the supramaxillaries. Rays of branchiostegous membrane mostly four, more seldom five. Teeth

various, linguals none. Pseudobranchiæ none. Swimming-bladder bipartite transversely, conjoined with the labyrinth of ear by interposition of small bones (as in the *Cyprini* and *Siluroïdei*).

Like the preceding genera these also are almost all found in S. America.

This family was separated from that of the salmons by JOH. MUELLER (MUELLER'S *Archiv*, 1842, p. 307; JOH. MUELLER *und* F. H. TROSCHEL, *Horæ Ichthyologicæ, Beschreibung und Abbildung neuer Fische, Erstes und zweites Heft.* Berlin, 1845, 4to). Besides the characters already stated it differs from the salmons in having oviducts, which in the latter, where the eggs fall into the cavity of the abdomen, are wanting (see above, p. 38). Not only in the swimming-bladder, but also in external appearance, many species resemble the genus *Cyprinus*. They have however many blind appendages at the pylorus, which are absent in *Cyprinus*.

A. *Dorsal fin single, supported by rays.*

Erythrinus GRONOV. Body oblong, round, covered with large scales. A row of conical, unequal teeth in both jaws. Teeth in palate thin and crowded. Branchiostegous membrane with five rays. Dorsal fin placed over the ventrals. Caudal fin rounded.

Sp. *Erythrinus Gronovii* VAL., *Synodus erythrinus* BLOCH, GRONOV. *Mus. Ichth.* Tab. VII. fig. 6; from Surinam. Also the rest of the species of this genus are from South America, and the name of *Esox malabaricus*, given by BLOCH to a species of *Erythrinus* (*Ichth.* Tab. 392), is founded in error. This species and some others belong to the genus *Macrodon* MUEL., in which the lower jaw has some very large conical teeth, whilst a row of larger teeth, parallel with the teeth of the upper jaw, is found at the fore part of the palate. In those which are named *Erythrini* by MUELLER in a proper sense (*Erythrinus* GRONOV. &c.) the small teeth in the palate stand in two lateral masses, and the teeth of the lower jaw are more similar to each other in size. In these the posterior division of the swimming-bladder is cellular. See H. S. R. JACOBI *De vesica aërea Piscium. Diss. inaug.* Berolini, 1840, 4to, pp. 23—25; MUELLER *Archiv f. Physiol.* 1842, pp. 307—309.

Note.—Genera *Lebiasina*, *Pyrrhulina* VAL. is this their place? The swimming-bladder is bipartite; but the absence of oviducts in *Lebiasina* noticed by the author would suggest the negative. The fishes are unknown to me. Compare CUVIER *et* VALENCIENNES, *Hist. Nat. des Poiss.* XIX. pp. 531—537.

B. *Dorsal fins two, the posterior adipose* (*Charax* GRONOV.)

† *Gape of mouth small or moderate.*

Prochilodus AGASS., *Pacu* SPIX, MUELL. Palate smooth. A double row of very thin and very small teeth in lips.

Sp. *Prochilodus argenteus* AGASSIZ, *Curimata* MARCGR. *Hist. Nat. Bras.* p. 156.

Characinus LACEP. (in part). Palate smooth. Teeth in maxillary bone and in lower jaw in a single row or none. Branchiostegous membrane with four rays, more rarely five. Abdomen not serrate.

Anodus SPIX, MUELL., *Curimata* CUV. (in part), *Curimatus* VAL. Teeth none. Body elongate.

Sp. *Characinus cyprinoïdes* LAC., *Salmo cyprinoïdes* L., *Salmo edentatus* BLOCH, *Ichth.* Tab. 330; Surinam.

Hemiodus MUELL. Teeth mobile, small, broad, with margin crenate in upper jaw; lower jaw edentulous. Body elongate.

Sp. *Characinus unimaculatus, Salmo unimaculatus* BLOCH, *Ichth.* Tab. 381, fig. 3; Surinam, &c.

Piabuca CUV., VALENC. (*Piabuca* and *Schizodon* AGASS., MUELL.). Teeth in intermaxillary bone and in lower jaw broad, serrate or pectinate at the margin. Pharyngeal teeth uncinate.

Sp. *Characinus argentinus, Piabuca argentina* CUV., *Salmo argentinus* L., BLOCH *Ichth.* Tab. 382, fig. 1, a very long anal fin; scales small.—*Characinus Schizodon, Schizodon fasciatus* AGASS., SPIX *Pisc. Brasil.* Tab. 36, with short anal fin and large scales; both from South America.

Leporinus SPIX, AGASS., MUELL. Teeth in intermaxillary bone and in lower jaw in a single row, small, procumbent, entire. Pharyngeal teeth uncinate.

Sp. *Characinus Friderici* LAC., *Curimatus acutidens* VALENC. formerly, *Salmo Friderici* BLOCH, *Ichth.* Tab. 378; Surinam.

Citharinus CUV. Teeth in intermaxillary bone and lower jaw very minute, setaceous or subulate.

a) With maxillary teeth numerous, setaceous; with pharyngeal teeth none. Dorsal fin placed over the space between the ventral fins and the anal fin. Sp. *Characinus Geoffroyi, Serrasalmo citharinus* GEOFFR., *Descr. de l'Egypte, Poiss.* Pl. v. figs. 2, 3. Habit. in the Nile.

b) With maxillary teeth few, subulate; with pharyngeal teeth flattened, uncinate. Dorsal fin placed over the ventrals. (*Chilodus* MUELL.) Sp. *Characinus chilodus, Chilodus punctatus* MUELL. and TROSCH. l. l. Tab. 57, fig. 2. Habit. in Guiana.

Epicyrtus MUELL. Teeth conical, unequal, in single row, interrupted in intermaxillary bone, supramaxillary and lower jaw. Palate smooth. Branchiostegous membrane with four rays. Body compressed, with abdomen not serrate. Ventral fins near to pectoral.

Sp. *Epicyrtus gibbosus* MUELL., *Salmo gibbosus* L., GRONOV. *Mus. Ichth.* Tab. I. fig. 4, CUV. *et* VAL. *Poiss.* XXII. Pl. 636; Surinam.

VALENCIENNES is of opinion that the genus *Exodon* MUELL. ought not to be separated from this.

Chalceus CUV. Teeth short, multicuspidate, in double or treble row in upper jaw, double or single row in lower jaw. Palate smooth. Body compressed, with abdomen not serrate. Scales large. Branchiostegous membrane with four rays.

Chalceus CUV., *Brycon* MUELL. and TROSCH. Teeth in a triple row in upper jaw, double in lower. Abdomen rotundate.

Sp. *Chalceus macrolepidotus* CUV., *Mém. du Mus.* IV. Pl. 21, fig. 1.

Tetragonopterus ARTEDI, MUELL. Teeth in double row in upper jaw, in single row in lower jaw. Abdomen rotundate.

Sp. *Chalceus Artedii, Coregonus amboinensis* ARTEDI, *Descr. specierum Pisc.* p. 44, SEBÆ *Thesaur.* III. Tab. 34, fig. 3, &c.

Brycinus VALENC.

Chalcinus VALENC., *Chalceus* MUELL. Double row of teeth in both jaws. Abdomen carinate.

Sp. *Chalceus branchipomus, Chalcinus branchipomus* VALENC., *Chalceus angulatus* SPIX.

Gasteropelecus GRONOV. Teeth tricuspidate, in intermaxillary bone in a double row, in single row in lower jaw. Teeth of supramaxillary bone conical, in a single row. Palate smooth. Body compressed, with abdomen convex, carinate. Ventral fins very small. Scales small.

Sp. *Gasteropelecus sternicla* PALL., *Clupea sternicla* L., GRONOV. *Mus. Ichth.* Tab. VII. fig. 5, PALLAS *Spicil. Zool.* VIII. Tab. 3, fig. 4; Surinam.

Myletes CUV. Teeth prismatic, tricuspid, in a double row in intermaxillary bone; teeth of lower jaw thick, with crown flattened, the two middle mostly conical, forming a second row. Supramaxillary bone edentulous. Palatine teeth none. Body compressed.

Alestes MUELL., VALENC. Abdomen rotundate. Scales large.

Sp. *Myletes Hasselquisti* CUV., *Cyprinus Dentex* L. (and *Salmo niloticus* ejusd.), CUV. *Mém. du Mus.* IV. Pl. 21, fig. 2, *R. Ani., éd. ill., Poiss.* Pl. 103, fig. 1, *Myletes Baramoze* JOANNIS, GUÉRIN *Magas. de Zool.* 1835, Cl. IV. Pl. 6; in the Nile, where it is named by the Arabs *Raji;* the scales fall off very readily; the caudal fin is large and deeply forked. This fish attains a length of 1′ to 15″.

Myletes CUV. (in part), MUELL. Abdomen carinate, serrate. Scales small.

Sp. *Myletes macropomus* CUV., *Mém. du Mus.* V. Pl. 21, fig. 8, &c. All these species are from S. America.

Tometes VALENC.

Myleus MUELL.

Serrasalmus CUV., LAC. Teeth in both jaws mostly in a single row, triangular, trenchant. Body compressed, with belly serrate. Scales small. Branchiostegous membrane with four rays.

a) *Palatine teeth none.*

Sub-genera: *Pygocentrus, Pygopristis, Catoprion* MUELL.

Sp. *Serrasalmus Piraya* CUV., *Mém. du Mus.* V. Pl. 28, fig. 4, *Piraya* or *Piranha* MARCGR. *Hist. nat. Bras.* p. 165; this and another species, *Pygocentrus niger* MUELL., swim together in large troops in the rivers of Brazil and Guyana; they are very voracious and so bold that they attack even large animals that chance to get into their shoal, and in a short time consume them to the bone. An ox cannot reach the far side of a stream only thirty or forty feet wide without nearly dying, and in part gnawed to a skeleton. The *Guaraunos,* who preserve their dead as skeletons, hang, according to GUMILLA, the bodies in the stream for a night, and on the following day have a clean-made skeleton[1].

b) *Palatine teeth triangular, acute, in a single row.*

Serrasalmo MUELL.

Sp. *Serrasalmus rhombeus* LACEP., *Salmo rhombeus* L., PALL. *Spicil. Zool.* VIII. Pl. 5. fig. 3, BLOCH *Ichth.* Tab. 383. Guiana, Surinam, &c.

†† *Gape of mouth large, produced beyond the eye. Abdomen not serrate.* *Hydrocyon* CUV.

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[1] SPIX *Pisc. Brasil,* Fasc. I. From such stories deductions may be made, and still much that is remarkable remains. See also the accounts respecting these gluttonous fishes by AUGUSTE DE SAINT-HILAIRE and SCHOMBURGK in CUVIER and VALENCIENNES *Hist. nat. des Poissons,* XXII. pp. 290, 291, 293, 294.

Cynopotamus VALENC. Teeth conical, acute, in the intermaxillary bone in a double row, in a single row in lower jaw. Branchiostegous membrane with five rays.

Habitus of *Epicyrtus*. Palate smooth. Scales small.

Salminus AGASS., MUELL. Teeth conical, in a double row in the intermaxillary bone and the lower jaw. Teeth of supramaxillary bone in a single row, conical, small. Branchiostegous membrane with four rays.

Sp. *Salminus Cuvieri* VALENC., *Hydrocyon brevidens* CUV., *Mém. du Mus.* v. Pl. 27, fig. 1, Brazil, &c.

Hydrocyon CUV. (in part). Teeth conical, large, in both jaws in a single row, the upper alternating with the lower.

† *Palate smooth.*

Hydrocyon AGASS., MUELL. Scales large. Branchiostegous membrane with 4 rays.

Sp. *Hydrocyon Forskahlii* CUV., *Mém. du Mus.* v. Pl. 28, fig. 1, in the Nile and also in the Senegal.

†† *Palate furnished with teeth.*

Xiphorhynchus AGASS. (*Xiphorhamphus* MUELL.).

Cynodon SPIX (*Raphiodon* AGASS., MUELL., and *Hydrolycus* MUELL.).

Note. Smaller conical teeth with larger mixed. Scales moderate or small. Species from S. America.

a) *Conical palatine teeth in a single row.*

Sp. *Hydrocyon falcirostris* CUV., *Xiphoramphus falcirostris* MUELL., *Mém. du Mus.* v. Pl. 27, fig. 3.

b) *Palatine teeth minute, with crowded granules. Branchiostegous membrane with 5 rays.*

Sp. *Hydrocyon scomberoide* CUV., *Cynodon scomberoides* VALENC., *Mém. du Mus.* v. Pl. 27, fig. 2.

Salanx CUV. Teeth in both jaws conical, incurved, unequal. Palatine bones with a single row of small teeth. Head depressed. Body elongate. Dorsal fin remote, placed behind ventral fins. Branchiostegous membrane with four rays.

Sp. *Salanx Cuvieri* VALENC., *Salanx Reevesii* VALENC., *Albula chinensis* OSBECK, *Leucosoma Reevesii* GRAY, VALENC. *Poiss.* XXII. p. 363, Pl. 646;

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almost the appearance of a *Belone*. The genus seems scarcely to differ from *Xiphorhynchus*[1].

Xiphostoma SPIX. Teeth in intermaxillary bone, in supramaxillary and in lower jaw thin, minute, numerous, in a single row. Bones of palate rough, with minute teeth. Head conical, acuminate. Branchiostegous membrane with five rays. Dorsal fin remote, placed behind ventral fins.

Sp. *Xiphostoma lucius* SPIX, *Hydrocyon lucius* CUV., *Mém. du Mus.* v. Pl. 26, fig. 2, and some other species from S. America.

Family XVI. *Scopelini* MUELL. Body in some scaly, in others naked. Teeth acute, conical in jaws, mostly also in palate and tongue. Branchiostegous membrane mostly with numerous rays. Pseudobranchiæ. Dorsal fins two, the posterior adipose, sometimes with obsolete rays. Ovaries furnished with oviduct. Swimming-bladder mostly none.

If this small family be still to be separated from the following, the presence of oviducts remains as the most important character, whilst it is distinguished from the preceding by false gills. The character that the upper margin of the oral aperture is formed by the intermaxillary bones prevails indeed in many, *ex. gr. Scopelus* and *Saurus*, but is by no means general. In *Paralepis* a swimming-bladder is found, which is wanting in the rest.

a) *Intermaxillary bones forming with supramaxillary the upper margin of mouth.*

Sternoptyx HERMANN. Body compressed, high, scaleless. Maxillary teeth small, short, in several rows, palatine teeth few. Branchiostegous membrane with five rays. Ventral fins very small. A long, low, membranous fold in the place of an adipose fin.

Sp. *Sternoptyx diaphana* HERMANN, *Naturforscher*, XVI. Tab. I. figs. 1, 2, s. 8—36; CUVIER *R. Ani.*, éd. 2, Pl. 13, fig. 1; in the Atlantic Ocean near the tropics; a small fish about two inches long, which is found only seldom.

Argyropelecus COCCO. Body compressed, high, naked, with tail attenuate. Maxillary teeth subulate, unequal, in a single row. Branchiostegous membrane with nine rays.

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[1] The tongue, according to VALENCIENNES, is armed with teeth. This causes us in some degree to doubt whether the genus be rightly placed here.

Sp. *Argyropelecus hemigymnus* Cocco, C. L. Bonap. *Faun. Ital.* III. Tab. 121, fig. 3, Cuv. *R. Ani., éd. ill., Poiss.* Pl. 103, fig. 3; with round silvery spots along the belly, 1½ inch long; in the Mediter. Sea;—*Argyropelecus Olfersii* Valenc., *Sternoptyx Olfersii* Cuv. *R. Ani.*, sec. édit., Pl. 13, fig. 2; from the Atlantic Ocean near the Canary Islands, and found close to the Cape of Good Hope, from which last locality the museum of Leyden has received specimens of this species.

Gonostoma Rafin., Valenc., *Gonostomus* Cocco. Intermaxillary bones short, the supramaxillary especially forming the upper margin of mouth. Maxillary teeth in a single row, acute, conical, in most very small, with few large interposed. Palatine teeth small, sharp, crowded. Branchiostegous membrane with fourteen rays. First dorsal fin remote, placed over the commencement of the long anal fin. Scales moderate, deciduous.

Gonostoma denudata (or better, *Gonostomus acanthurus* Cocco) C. L. Bonaparte, *Faun. Ital.* III. Tab. 119, fig. 1, Mediter. Sea.

Chauliodus Bloch, Schn. Head large, short in front of eyes, with gape of mouth very large. Maxillary teeth in a single row, conical, acute, the anterior long, exsert. Palatine teeth remote, acute, in a single row. Anterior dorsal fin near the head, remote from the second by a long interval. Scales large, thin, deciduous. Branchiostegous membrane with seventeen rays.

Sp. *Chauliodus Sloani* Bloch, *Syst. Ichth.* Tab. 85, *Chauliodus setinotus* Bonap. *Faun. Ital.* III. Pl. 123, fig. 2, Medit. Sea.

b) *Intermaxillary bones long, descending by the side of supramaxillary, forming the upper margin of mouth.*

Scopelus Cuv. Maxillary teeth small, numerous, in several rows; palatine teeth very small, tongue smooth. Gape of mouth large. Branchiostegous membrane with nine rays. Scales often deciduous.

Sp. *Scopelus Humboldtii* Cuv., *Gasteropelecus Humboldtii* Risso, *Ichthyol. de Nice*, 1810, Pl. 10, fig. 38;—*Scopelus Benoisti* Bonap. *Faun. Ital.* III. Tab. 119, fig. 4, Medit. Sea;—*Scopelus borealis* Nilsson, Stroem *Skrivter af Naturhistorie-Selskabet*, II. 2, 1793, Tab. I. fig. 2, from the coast of Norway, &c. They are all small fishes with silvery spots on the sides, and below on the belly.

To this genus ought to be referred *Lampanyctus*, *Ichthyococcus* of C. L. Bonaparte, *Maurolicus* Cocco, Bonap., and *Myctophum* Rafin., Bonap. To *Maurolicus*, which genus J. Mueller retains, this author refers the *Scopelus borealis*, which we have recorded above.

Odontostomus Cocco. Upper teeth in intermaxillary bone small, recurved, lower teeth elongate, acuminate, mobile. Palate armed with long teeth. Branchiostegous membrane with 8 rays.

Sp. *Odontostomus hyalinus* Cocco, Bonap. *Faun. Ital.* III. Pl. 120, fig. 6; this species appears to have no scales; it becomes 5″ long, and lives in the Medit. Sea.

Saurus Cuv. (and *Saurida* Valenc.). Teeth subulate, crowded in jaws, in several rows, the internal longer; in tongue and palate teeth acute, numerous. Branchiostegous membrane with sixteen rays, or more[1].

Sp. *Saurus fœtens* Valenc., *Salmo fœtens* L., *Encycl. méth. Poiss.* Pl. 70, fig. 285 (copied from the figure of Catesby);—*Saurida nebulosa* Valenc., *Poiss.* XXII. Pl. 643, &c.

Aulopus Cuv. Teeth small, acute in maxillæ, palate, vomer and tongue. Ventral fins placed almost under pectoral. Scales large. Eyes large. Branchiostegous membrane with 10—16 rays.

a) *Branchiostegous membrane with 16 rays.*

Sp. *Aulopus filamentosus, Salmo filamentosus* Bloch, *Schriften der Gesellsch. naturf. Freunde zu Berlin*, X. 1792, s. 424, Tab. IX. fig. 2, Bonap. *Faun. Ital.* III. Tab. 121, fig. 1; in the male three rays of the dorsal fin are much elongated; the margin of the scales is as though haired with fine spines. In the Medit. Sea.

b) *Branchiostegous membrane with 10 rays.*

Sp. *Aulopus Agassizi* Valenc., *Chlorophthalmus Agassizi* Bonap. *Faun. Ital.* III. Tab. 121, fig. 2; also in the Mediter. Sea.

Paralepis Cuv., Risso. Teeth very small in intermaxillary bone, teeth of lower jaw and palate subulate, acuminate, larger, with smaller interposed. Branchiostegous membrane with seven rays. First dorsal fin remote. Body elongate, scaly.

Sp. *Paralepis coregonoides* Risso, Cuv. *et* Val. *Poiss.* III. Pl. 67, Guérin *Iconogr., Poiss.* Pl. X. fig. 3, from the Medit. Sea. With this is nearly allied *Paralepis borealis* Reinh., *Königl. Danske Videnskabernes Selskabs Afhandl.* VII. 1838, pp. 115, 125, 126, from Greenland and Iceland. Risso referred this genus first to the *Salmonidæ*, Cuvier afterwards to the *Acanthopterygii* close to *Sphyræna;* Reinhardt again assigned it a place

[1] Valenciennes found the extraordinarily large number of 25 branchial rays in *Saurus Ophiodon.*

amongst the *Malacopterygii*. See the fifth part of the *Natural-History Transactions* of the Royal Society at Copenhagen, 1832, s. LXXV. LXXVI.

Sudis RAFINESQUE, BONAP., MUELL. (not CUV.). Palate with a serrate carina, edentulous. Inferior teeth flat.

Sp. *Paralepis hyalinus* CUV., *Sudis hyalina* RAFIN., BONAP. *Faun. Ital.* III. Tab. 124, fig. 1; the scales, with the exception of those of the lateral line, readily fall off; the dorsal fin is placed in front of the ventral fin. The palate would appear to have no teeth, but to be serrate. In the Mediter. Sea.

Family XVII. *Salmonacei*. Body scaly, with scales sometimes deciduous. Second dorsal fin adipose. Superior margin of mouth formed at the sides by the supramaxillary bones. Branchiostegous membrane with 6—13 rays (mostly 10—12). Pseudobranchiæ pectinate. Swimming-bladder simple. Ovaries without oviduct, the ova falling from the ovaries into the cavity of abdomen.

Argentina L. (in part). Teeth in tongue and vomer; in maxillæ none. Branchiostegous membrane with six rays. Scales deciduous.

Sp. *Argentina sphyræna* L. (not GRONOV.), RONDELET *de Piscib. mar.* p. 227, *la petite sphyrène*, BRUNNICH *Ichthyol. Massiliensis*, Hafniæ, 1768, pp. 79, 80, GOUAN *Histor, Pisc.* pp. 197, 198, CUVIER. *Mém. du Mus.* I. 1818, pp. 228—236, Pl. XI. fig. 1; in the Mediter. Sea; becomes only 8 or 10″ long; the stomach is dull-black; the swimming-bladder glistering and silvery. BRUNNICH first recognised the affinity of this fish with the salmons.

Salmo L. (exclusive of *Characini*). Teeth in jaws, palate, vomer and tongue in most, in some no teeth. Branchiostegous membrane with 7—13 rays. Body scaly.

A numerous genus of fishes, especially in northern Europe[1]. The following sub-genera may be adopted.

Coregonus CUV. Teeth none. Branchiostegous membrane with 7—9 rays. Body elongate, with head acuminate. Scales moderate. Caudal fin forked.

Sp. *Salmo oxyrhynchus* L., BLOCH *Ichth.* Tab. 25 (under the name of *Salmo Lavaretus*), CUV. *et* VAL. *Poiss.* XXI. Pl. 630. The head ends in a pointed snout, prolonged in front of the mouth. This fish, called by the Dutch

[1] Compare Sir WILLIAM JARDINE *Nat. History and Illustrations of the Scottish Salmonidæ*, folio, 1841 and foll.

Houting, is found in the North, and in March and April occurs frequently in the mouths of their rivers; the ventral fins begin behind the middle of the dorsal fin; there are 7 rays in the gill-membrane.

Salmo Lavaretus Cuv., *Salmo Wartmanni* Bloch. *Ichth.* Tab. 105, Cuv. *et* Val. *Poiss.* xxi. Pl. 627; 8 rays in the gill-membrane; the head is not prolonged beyond the mouth; from the lakes of Switzerland (*Salmo Lavaretus* L. is a collection of different species).

Coregonus Willughbii Jardine, Yarrell *Brit. Fish.* ii. p. 89; in lakes of the south of Scotland (*Dumfries*); this fish appears to feed principally on small fresh-water crustaceans, water-fleas, &c.[1]

Thymallus Cuv. Teeth very short, conical, in a single row in jaws; palate furnished with very small and few teeth. Tongue smooth. Dorsal fin long, high. Caudal fin forked. Branchiostegous membrane with 8—10 rays.

Sp. *Salmo Thymallus* L., Bloch *Ichth.* Tab. 24 (probably *Thymallus gymnothorax* Val., Cuv. *et* Val. *Poiss.* Pl. 625), &c.

In these fishes the dorsal fin has 20 or more rays, whilst there are about 15 in the species of the preceding sub-genus.

Mallotus Cuv. Teeth very short, conical in palate and maxillæ, somewhat longer in tongue. Pectoral fins large. Dorsal fin placed over ventrals. Caudal fin forked. Branchiostegous membrane with 8 rays. Scales small.

Sp. *Salmo arcticus* O. Fabr., *Clupea villosa* Gmel., *Salmo grœnlandicus* Bloch. *Ichth.* Tab. 381, fig. 1, Cuv. *et* Val. *Poiss.* Pl. 622; in the male along the lateral line are long narrow scales standing close together, which from their softness resemble felt. These fishes are sometimes found on the shore of Greenland, inclosed, as modern petrifactions, in a clayey earth. See the figures in Agassiz *Poiss. foss.* v. Pl. 60. Comp. *ibid.* v. 2, pp. 98—100, *Mallotus villosus.*

Osmerus Artedi (in part), Cuv. Teeth in maxillæ small, incurved, conical, in vomer and tongue thick, in palate conical in a double row. Branchiostegous membrane with 8 rays. Caudal fin forked.

Salmo Eperlanus L., Bloch *Ichth.* Tab. 28, fig. 2, Cuv. *et* Val. *Poiss.* xxi. Pl. 620; the *smelt;* occurs abundantly at the mouth of rivers in Holland, confined to the eastern and western coasts of Great Britain, Yarrell *Br. Fishes,* ii. p. 75.

Salmo Cuv. (*Salar, Fario, Salmo* Valenc.). Teeth conical, in a single row in maxillæ; teeth in vomer, in palate and tongue.

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[1] *Cyclops,* see Vol. i. p. 632, *Daphnia* 641, &c.

Branchiostegous membrane mostly with 10 or 11 rays (rarely with 9 or 12). Caudal fin truncate or concave posteriorly, emarginate.

Salmo Fario L., BLOCH *Ichth.* Tab. 22, *Salar Ausonii* VAL., CUV. *et* VAL. *Poiss.* XXI. pl. 618; the *trout;* in small, rapid streams.

Salmo Salar L., BLOCH *Ichth.* Tab. 20, *Salmo Salmo* VALENC., CUV. *et* VAL. *Poiss.* XXI. Pl. 614; the *salmon, le Saumon, der Lachs;* 11 broad gill-rays, the back dark blue, with dark brown round spots, which, after a residence for some time in fresh water, become indistinct. This is the largest species of this genus, which attains a length of 3'; some have been taken which weighed 50 lbs. (old Dutch). This fish lives in winter in the sea after having shot its spawn in fresh water. The eggs lie 100 days or more before being hatched (in the spring). In the Mediterranean this species does not occur; it particularly abounds in Scotland and Norway. The skeleton is figured by ROSENTHAL, *Ichthyot. Tafeln,* Tab. VI. fig. 1.

Family XVIII. *Esocii.* Body mostly covered with scales. Dorsal fin near caudal, almost opposite to anal; no second adipose fin. Margin of upper jaw partly formed by intermaxillary bone; supramaxillary bones edentulous. Swimming-bladder simple. Pyloric appendages none. Pseudobranchiæ latent, glandular.

† *Inferior pharyngeal bones two.*

Galaxias CUV. Body naked. Branchiostegous membrane with 6—9 rays.

Sp. *Galaxias truttaceus* CUV., CUV. *et* VAL. *Poiss.* XVIII. Pl. 543;—*Galaxias attenuatus* VALENC., *Mesites attenuatus* JENNYNS, CUV. *R. Ani., éd. ill., Poiss.* Pl. 97, fig. 2, &c. Small fresh-water fishes from the southern hemisphere. J. MUELLER, who would either make a distinct family of them or unite them with the preceding, has drawn attention to the absence of oviducts.

Esox L. (in part) CUV. Body elongate, scaly, with snout oblong, obtuse, depressed. Intermaxillary bones small, armed with small sharp teeth. Teeth in lower jaw conical, unequal. Teeth in vomer and palate subulate, small, crowded. Branchiostegous membrane with 13—16 rays.

Sp. *Esox Lucius* L., BLOCH *Ichth.* Tab. 32, *Skandinaviens Fiskar,* Pl. 10; the *pike, le Brochet, der Hecht;* the gill-membrane has mostly fourteen rays, the number however is variable, sometimes even different on the two sides, in one and the same fish; the colour on the head and back is dark olive-brown, at the sides spotted yellow, white below. This species is found in the rivers of the whole of Europe and north of Asia, and even in some lakes of North America (the *lake Huron,* for instance, RICHARDSON *Faun. boreal.*

Amer. III. p. 124, &c.), from which however another species must be distinguished which occurs in North America alone. The pike rarely attains a length of more than three feet, or weighs more than twelve pounds, although some have been taken that weighed twenty, thirty, or more pounds. The pike is a very voracious, predacious fish, which feeds on other fresh-water fishes, even of its own species, on frogs, rats, &c.; it may attain a great age[1].

Some other species of pike are also found in North America, as *Esox americanus* LAC. (probably the species announced by SCHOEPF *Naturforscher*, XX. p. 26), also *Esox estor* LESUEUR, CUV. *et* VAL. *Poiss.* Pl. 542, &c. The entire genus would seem to be confined to the northern hemisphere did we not know from PÉRON'S *Voyage* of a species which he appears to have caught in Van Diemen's Land.

Stomias CUV. Body elongate, with head short and gape of mouth large. Lower jaw longer than upper. Teeth long, conical, in an interrupted row in intermaxillary bone and lower jaw. Cirrus under the throat. Branchiostegous membrane with seventeen rays.

Sp. *Stomias boa* VAL., CUV. *et* VAL. *Poiss.* XVIII. Pl. 545, from the Mediterranean Sea; much resembling *Chauliodus*, and perhaps not belonging to the present family.

†† *Inferior pharyngeal bone single.* (*Pharyngognathi malacopterygii* MUELL.) Body elongate, carinate on both sides, with a row of longitudinal scales. Swimming-bladder closed.

Belone CUV. Both jaws produced into a subulate snout, the lower beyond the apex of upper. Small teeth in both jaws; some larger, conical, mixed with the smaller; palate bones edentulous. Branchiostegous membrane with 12—14 rays. Scales small.

Sp. *Belone vulgaris* VALENC., *Esox Belone* L. (excl. syn.), BLOCH *Ichth.* Tab. 33, YARRELL *Brit. Fishes*, I. p. 391, the *gar-fish, horn-fish, Hornhecht, Orphie;* in the North Sea; this fish may attain the length of full two feet; according to VALENCIENNES small teeth on the vomer distinguish this species from the rest, even from a very similar Mediterranean species with which it is usually confounded (*Belone acus* RISSO, C. BONAPARTE *Faun. Ital.* Tab. 122, fig. 1). Yet this character would seem at the least to be insecure, for KROEIJER in the specimens from the North Sea examined by him did not meet with these teeth. But in a specimen from our (Dutch) coasts I found

[1] There is an account or a story respecting a pike which was placed in a fish-pond at Heilbron by the Emperor Frederic II. in 1230, with a Greek inscription on a ring, and fished up again in 1497, having been thus more than 267 years old; it was 19 feet long. Compare OKEN'S *Lehrbuch der Zoologie*, II. 1816, s. 100, 101, and VALENCIENNES in CUV. *et* VAL. *Poiss.* XVIII. pp. 305—312.

small acute teeth on the vomer as VALENCIENNES did, and believe that KROEIJER had overlooked them. *Denmark's Fiske*, III. 1846, pp. 276—277.

The spines have a lively green colour. The ribs are very delicate, and the gill-covers thin, transparent, bony plates. Very young fishes have been met with about 1" long, with a short upper snout which has been regarded as a species of *Hemiramphus*, but are the young of *Belone*. See such a fish, found by Prof. BEHN in the Baltic in June 1842, and figured and described by him in my *Tijdschrift voor natuurlijke Gesch. en Physiologie*, X. 1843, bl. I—II, and HORNSCHUCH, *ibid.* bl. 295—300. In the western hemisphere also and in the East Indies species of this genus occur, living partly in fresh water, partly in the sea.

Scomberesox LAC., *Sayris* RAFIN., BONAP. Teeth very small, in a single row in both jaws; palatine teeth none. Tongue smooth. Snout acuminate, protracted, lower jaw the longer. Branchial aperture large. Branchiostegous membrane with 12—15 rays. Body elongate, compressed, with small deciduous scales. Several pinnules behind dorsal and anal fins, as far as caudal fin.

This genus is very similar to the preceding, and is principally distinguished by the many small dorsal and anal fins. A species has been found in the Mediterranean Sea, *Scomberesox Rondeletii* VALENC., *Saurus* RONDELET, *de Piscib.* p. 232, BONAP. *Faun. Ital.* III. Tab. 122, fig. 2, which is distinguished from that of the Atlantic Ocean and the North Sea (*Scomberesox Camperi* LACEPÈDE, *Poiss.* V. Pl. 6, fig. 3, YARRELL *British Fishes*, I. p. 394), according to VALENCIENNES, by the absence of a swimming-bladder.

ERNST HAECKEL *Ueber die Eier der Scomberesoces*, MUELL. *Archiv*, 1855, s. 23—31. Pl. IV. u. V.

Hemiramphus CUV. Teeth small, crowded into a narrow belt around the margin of each jaw; palatine teeth none. Symphysis of lower jaw produced into a narrow process beyond the row of teeth; upper jaw short, triangular. Branchiostegous membrane with 10—14 rays. Scales large. Body elongate, with back rotundate or flat.

Sp. *Hemiramphus Brownii* VALENC., *Esox brasiliensis* L. (in part), BROWNE *Jamaica*, Tab. 45, fig. 2. *Encycl. méth., Poiss.* Pl. 72, fig. 298; West Indies and Atlantic Ocean. There are also species in the East Indies, amongst which *Hemiramphus longirostris* VALENC., CUV. *R. Ani., éd. ill., Poiss.*, Pl. 98, fig. 2, is distinguished by very large pectoral fins.

Exocoetus L. Teeth very small in the anterior part of both jaws. Palate edentulous. Gape of mouth small. Branchiostegous

membrane with 10—11 rays. Scales large. Pectoral fins elongate. Caudal fin forked, with inferior lobe larger.

Flying fishes. In some species the pectoral fins are as long as the body; by means of these long fins these fish can keep themselves for a time above the water. (See above, p. 51). They are all marine fishes, of which more than thirty species are now known, though LINNÆUS recorded two of them only, namely *Exocoetus volitans* L., (CUV. *et* VALENC. *Poiss.* XIX. Pl. 559), principally in the Mediterranean Sea, and *Exoc. evolans* L., BLOCH *Ichth.* Tab. 398, occurring in the North Sea, the Atlantic, and also in the Southern Pacific.

Family XIX. *Mormyrini.* Upper margin of mouth formed by the intermaxillary and supramaxillary bones; mouth small; teeth in intermaxillary bone and lower jaw compressed, small, emarginate or tricuspid; teeth in vomer and tongue subulate, crowded. Branchial aperture small, linear; branchiostegous membrane with few (5—6) rays. Body compressed, covered with small scales; head with naked thick skin. Dorsal fin single, often long. Swimming-bladder simple, furnished with a duct.

Mormyrus L.

Fresh-water fishes from Africa, of which several species are now known. They differ from the fishes of the preceding family by a longer intestinal canal, and two blind tubes (*appendices pyloricæ*). At the posterior margin of the mastoid bone (see above, p. 20,) there is a large oval aperture, which was discovered by HEUSINGER in *Mormyrus cyprinoides*, and which is covered by a scale-like *os supratemporale* (see above, p. 22 note); under the opening lies the sac of the vestibule.

See MECKEL'S *Archiv für Anat. u. Physiol.* 1826, s. 324—327, Tab. IV. figs. 8—10.

At the tail, which is thickened, are situated on each side under the lateral muscle two elongate organs, which cause the thickening, divided into a number of spaces, and probably to be regarded as electric organs, although, as far as I know, nothing has yet been ascertained respecting the electric power of these fishes.

ERDL and GEMMINGER observed this arrangement in *Mormyrus oxyrhynchus* and *M. dorsalis*, KOELLIKER in *Mormyrus longipinnis* RUEPPELL; see KOELLIKER'S description with figures, *Berichte von der königl. Zootomischen Anstalt zu Würzburg*, II. 1849, s. 9—13. See also J. HYRTL, *Anatomische Mittheilungen über Mormyrus und Gymnarchus*, Wien, 1856, 4to. Mit 6 Tafeln. (XII. *Bd. der Denkschr. der math. natur. Classe der Kaiserl. Akad. der Wissensch.*)

HYRTL has figured remarkable *diverticula* at the bulb of the arterial stem of the gills.

Sp. *Mormyrus longipinnis* RUEPPELL, *Mormyrus Caschive* HASSELQUIST, *It. Palæst.* pp. 398—400;—*Mormyrus Geoffroyi* VALENC., *Centriscus niloticus* BL., SCH. *Syst. Ichth.* Tab. 30, fig. 1;—*Mormyr. oxyrhynchus* GEOFFR., *Mormyr. kannume* FORSK. *Descr. Animal.* p. 74, GUÉRIN *Iconogr., Poiss.* Pl. 51, fig. 1;—*Morm. anguilloides* L., SONNINI *Voyage en Egypte*, Pl. 22, fig. 1, *brain*, &c.

Gonorhynchus GRONOV. (Genus of uncertain position). Mouth edentulous, inferior; middle cirrus in front of mouth. Small scales covering body and head. Body elongate. Ventral fins somewhat near to tail; dorsal fin over the ventral fins. Branchiostegous membrane with 4 rays.

Sp. *Gonorhynchus Gronovii* VALENC., *Cyprinus Gonorhynchus* L., GRONOV. *Zoophyl.* Tab. x. fig. 2, CUV. *et* VAL. *Poiss.* XIX. Pl. 568, from the Cape of Good Hope.—*Gonorh. abbreviatus* SCHLEG. *Fauna Japonica*, Tab. 103, fig. 5.

There are several blind appendages at the pylorus, nine in *Gonorhyn. Gronovii*, according to VALENCIENNES; there is no swimming-bladder. These peculiarities sufficiently indicate that LINNÆUS incorrectly united the genus *Gonorhynchus* with *Cyprinus*.

Family XX. *Clupeacei.* No adipose dorsal fin. Upper jaw composed of small intermaxillary bones and supramaxillary placed at the sides. Body covered with distinct scales, often large. Swimming-bladder furnished with a duct in most. Pyloric appendages in very many. Pseudobranchiæ similar to branchiæ or none. Inferior pharyngeal bones two.

This family has a very close affinity with *Exocœtus* and *Hemiramphus* amongst the *Esoces*, which is interrupted by the preceding family placed between the two in a linear arrangement. Still these two genera possess in the unpaired inferior pharyngeal bone a very aberrant character.

See HYRTL *Ueber die accessorischen Kiemenorgane der Clupeaceen nebst Bemerkungen über der Darmkanal derselben.* Mit 3 Tafeln. Aus dem Xten Bande der *math. natur. Classe der Kaiserl. Ak. der Wissensch.* besonders abgedruckt. Wien, 1855.

Osteoglossum VANDELLI, *Ischnosoma* SPIX. Body compressed, covered with large scales. Head naked, with large infraorbital bones covering the cheeks. Eyes at the apex of snout. Gape of mouth large, teeth conical, acute, small in jaws, vomer, palate and tongue. Two cirri at the symphysis of lower jaw. Branchiostegous membrane with 10—15 rays. Dorsal fin remote, beginning behind anal; anal fin very long, approximate to caudal.

Sp. *Osteoglossum Vandellii* Cuv. *et* Valenc. *Poiss.* xix. Pl. 571; in the river Amazon. The dorsal fin is long; the gill-membrane has 10 rays; there are two pyloric appendages, as in *Mormyrus*.—*Osteoglossum formosum* Mueller and Schlegel, *Verhand. over de nat. Geschiedenis der Nederl. overzeesche Bezittingen*, 1839—1844, *Pisces*, Tab. 1, has a short dorsal fin, and 15 rays in the gill-membrane. This species occurs in lakes and rivers in the south of Borneo. (*Ischnosoma picirrhosum* Spix, *Select. Spec. et Gener. Pisc.* Tab. 25, corresponds exactly with *Osteoglossum Vandellii*, except that the anal fin is confluent with the caudal fin. Valenciennes thinks that this may be an occasional malformation.)

Sudis Cuv. (not Rafin.), *Arapaima* Muell., *Vastres* Valenc. Body elongate, covered with large hard scales. Head covered with thick scaleless skin. Teeth conical in jaws, the upper in a single row. Teeth crowded and acute in vomer, sphenoid, palatine and pterygoid bones, and in tongue. Branchiostegous membrane with 16 rays. Dorsal fin and anal remote, short, covered, as is caudal fin, with scales.

Sp. *Sudis gigas* Cuv., *Vastres Cuvieri* Valenc., Cuv. *R. Ani.*, 1817, Pl. x. fig. 4 (ed. 2, 1829, Pl. xii. fig. 4), and some other species; see Valenciennes in Cuv. *et* Val. *Poiss.* xix. pp. 433—464. These fishes attain a length of 6 or even 8 feet, and live in the river Amazon.

Heterotis Ehrenb. (spec. of *Sudis* Cuv., Ruepp.). Body covered with large hard scales. Maxillary teeth recurved, slender, approximate, in a single row; teeth in pterygoid bones setaceous; vomer, sphenoid and palate-bones edentulous. Branchiostegous membrane with 8 rays. Dorsal and anal fins remote, elongate, depressed; caudal fin small, rotundate; scales in these fins none.

Sp. *Heterotis Ehrenbergii* Valenc., *Sudis niloticus* Rueppell *Beschr. u. Abb. mehrerer neuer Fische*, 1829, Tab. 3, fig. 2, Cuv. *et* Val. *Poiss.* xix. Pl. 584 (at the third branchial arch Ehrenberg found an enigmatical conical appendage with a spiral canal).—A similar species occurs in the Senegal, *Heterotis Adansoni* Valenc.

This genus also has, like Osteoglossum, two pyloric appendages, which here are large.

Notopterus Lacep. Body towards the tail recurved, compressed, covered with small scales; abdomen bicarinate, serrate. Teeth acute, crowded, in several rows in margin of jaws; lesser teeth crowded in palate, vomer and sphenoid bones. Branchiostegous membrane with 6—8 rays. Cheeks and opercles scaly. Ventral fins very small. Dorsal fin small, high, almost in middle of back.

Anal fin covered with small scales, very long, confluent with caudal.

Sp. *Notopterus Pallasii* nob., *Gymnotus notopterus* PALL., *Spicil. Zool.* VII. Tab. 6, fig. 2, &c. East Indian fresh-water fishes, which resemble *Silurus* in the defect of the *sub-operculum*. They have affinity with *Mormyrus*, and, notwithstanding their small scales, with *Osteoglossum*.

Chirocentrus CUV. Body covered with very minute scales, compressed, with abdomen carinate. Lower jaw produced beyond upper. Teeth conical in jaws, the lower and two middle upper larger; teeth very small in palate, in vomer none. Branchiostegous membrane with 8 rays. Pectoral fins inserted in a furrow between two lamellæ, hard, triangular, acute, covered with scales. Ventral fins very small. Dorsal fin placed over anal, shorter than anal.

Sp. *Chirocentrus dorab* VAL., *Clupea dorab* FORSK., *Esoce chirocentre* LACEP. *Poiss.* v. Pl. 8, fig. 1; in the Red Sea and the Indian Ocean.

Alepocephalus RISSO. Body covered with large thin scales. Head naked. Teeth very thin in a single row in intermaxillary bone and lower jaw. Palatine teeth very small, in vomer and tongue none. Branchiostegous membrane with 6 rays. Dorsal and anal fins scaly at the base, opposite to each other, remote.

Sp. *Alepocephalus rostratus* RISSO, CUV. *et* VAL. *Poiss.* XIX. Pl. 566; in the Mediterranean Sea at great depths. This fish has no swimming-bladder. CUVIER refers it to the *Esocii*, but there are here twelve pyloric appendages, which, beside other characters, oppose this.

Lutodeira VAN HASS., RUEPPELL, *Chanos* LACEP. Mouth edentulous. Body covered with scales, moderate. Two triangular scaly lamellæ at the base of both pectoral and ventral fins. Caudal fin deeply forked, with two horny lamellæ on each side at the base of lobes. Branchiostegous membrane with 4 broad rays. Branchial aperture ample, produced under the throat.

Sp. *Lutodeira chanos* RUEPP., *Mugil chanos* FORSK. *Descr. Animal.* p. 74; Red Sea;—*Lutodeira orientalis* VAN HASS., *Bantam*, RENARD *Poissons, Ecrevisses et Crabes de la Mer des Indes*, Pl. 34, fig. 184; Indian Ocean, &c.

Butyrinus COMMERS., *Albula* GRONOV., VALENC. Body elongate, covered with scales, hard, moderate. Head naked, with conical snout produced beyond mouth. Teeth small, crowded, conical, acute, in intermaxillary bone, in palate and in lower jaw; teeth

granular, round in sphenoid bone. Branchiostegous membrane with 11—13 rays.

Sp. *Butyrinus Plumieri, Albula macrocephala* VALENC., *Albula Plumieri* BLOCH, *Syst. Ichth.* Tab. 86, LACEP. *Poiss.* v. Pl. 14, fig. 1; West Indian Sea.—*Butyrinus bananus, Argentina glossodonta* FORSK., LACEP. *Poiss.* v. Pl. 8, fig. 2; in the Indian and Red Seas[1].

Hyodon LESUEUR. Body compressed, with belly carinate. Scales moderate. Teeth in jaws conical, with a single row in upper, a double row in lower. Teeth in vomer, in palate and pterygoid bone; teeth of tongue large, subulate, recurved. Branchiostegous membrane with 9—10 rays. Dorsal fin small, placed over the beginning of longer anal fin.

Sp. *Hyodon tergisus* LESUEUR, CUV. *et* VAL. *Poiss.* XIX. Pl. 572, &c.; fresh-water fishes of North America.

Elops L. Body elongate, with abdomen prominent, round, compressed towards the tail, covered with moderate scales. Gape of mouth ample. Teeth very small, crowded in jaws, vomer, sphenoid, palatine and pterygoid bones. Branchial aperture ample; branchiostegous membrane with 25—35 rays. Acute lamella at the base of pectoral and ventral fins, as well as above and below caudal fin.

Sp. *Elops saurus* L. (and *Argentina carolina ejusd.*), in the Western and Eastern hemispheres, in the Atlantic Ocean, the Red Sea, the Indian Ocean, &c.—*Elops lacerta* VALENC., CUV. *et* VAL. *Poiss.* XIX. Pl. 575, Western Coast of Africa.

Megalops LAC.

This genus almost agrees with the preceding, but is distinguished by a smaller number of gill-rays (22—25) and by the elongation of the last ray of the dorsal fin, which as a long thread reaches nearly to the caudal fin, also by larger scales and large eyes. Sp. *Megalops atlanticus* VALENC., *Cameripuguacu* MARCGR. *Hist. Brasil.* p. 179 (*Clupea gigantea* SHAW), which attains a length of 3'—12';—*Megalops indicus* VALENC., *Clupea cyprinoides* BROUSSONET, *Ichth., Decas* I. 1782, Tab. 9, CUV. *et* VAL., *Poiss.* XIX. Pl. 576; this species, which is often confounded with the preceding, appears to continue always much smaller.

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[1] To this genus, beyond doubt, belong the description and figure of *eenen zeldzamen visch, Conorhynchus* of C. NOZEMAN in the *Uitgez. Verhand.* III. p. 381, Pl. 25.—N. says that the fish was a native of the Mediterranean. Hitherto, however, no species of the genus from that sea is found in collections.

Clupea L. (excl. of some genera). Teeth in jaws, palate and tongue small; sometimes no teeth. Gape of mouth moderate. Superior maxillary bones divided into 3 laminæ. Jaws subequal, or lower produced beyond upper. Branchiostegous membrane with 6—8 rays. Body compressed, elongate, keel of abdomen serrate. Scales large, thin, deciduous.

A very numerous genus, which VALENCIENNES has lately divided into many small genera, based especially on the teeth. Since however the teeth are very fine, and occur sometimes in young fishes of the same species that are afterwards without them, since moreover many of these groups do not differ in *habitus* and other characters, we cannot adopt these divisions as *genera*, and even think that some of them are of little service as sub-genera for the distinction of the species. We shall, nevertheless, as far as our plan permits, follow them.

† *Supramaxillary bone adhering by a moveable joint to the end of the small intermaxillary bone. Lower jaw produced beyond the upper.*

A. *Very small teeth in vomer, tongue and palate. Jaws rough, with very minute teeth.*

Clupea VALENC. (and *Rogenia* ejusd.). Branchiostegous membrane with 8 rays.

Sp. *Clupea harengus* L., BLOCH *Ichth.* Tab. 29, fig. 1, CUV. *R. Ani., éd. ill., Poiss.* Pl. 104, fig. 1; the *herring, der haring, le hareng*, a fish of the North Sea, which does not occur in the Mediterranean, and of an astonishing fecundity. When WILLEM BEUKELZ at the end of the fourteenth century had discovered the mode of curing herrings, the capture of this fish, the great fishery of Holland, soon became a gold-mine for the country; which, in the seventeenth century sent out annually about two thousand herring-boats. VALENCIENNES has treated at length of the natural history, and of the history of the fishery, *Hist. nat. des Poiss.* XX. pp. 31—242.

Clupea alba YARR., *Rogenia alba* VALENC., YARR. *Brit. Fish.* II. p. 126, CUV. *et* VAL. *Poiss.* Pl. 601, has teeth not only on the palate-bones, but also on the pterygoids. This is the celebrated *white-bait* of the English. In the beginning of summer *white-bait dinners* are very common at Greenwich and Blackwall.

All the known species of this sub-genus are from the northern hemisphere; *Clupea pontica* belongs to the Black Sea, and a fourth different species to the coasts of North America.

B. *Teeth of vomer none; teeth in tongue, palatine and pterygoid bones. Jaws with teeth very small or none.*

Sardinella VALENC. Jaws edentulous. Dorsal fin placed over ventral fins. Branchiostegous membrane with 6 rays.

Harengula VALENC. Branchiostegous membrane with 6 or 7 rays.

Sp. *Clupea sprattus* L., YARR. *Brit. Fish.* II. p. 121; the *sprat.*—Most of the species of this sub-genus are exotic.

Pellona VALENC. Ventral fins placed before dorsal fin. Anal fin long. Branchiostegous membrane with 6 rays. Abdomen compressed, convex, sharply serrate.

Sp. *Clupea Iscrti, Clupea africana* BLOCH, &c.; numerous, all exotic, mostly East Indian species.

Pristigaster CUV. Ventral fins none. Abdomen as in sub. genus *Pellona.*

Sp. *Pristigaster cayanus* CUV., *R. Ani.*, Pl. X. fig. 3; éd. 2, Pl. XII. fig. 3. Species foreign.

C. *Teeth of vomer and of pterygoid bones none.*

Spratella VALENC. Teeth in palate bones and in tongue alone.

D. *Teeth of vomer and palate bones none.*

Clupeonia VALENC. Teeth in tongue and in pterygoid bones alone.

Sp. *Clupea Jussievi* LACEP. *Poiss.* V. Pl. 11, fig. 2; *Clupea melanura* CUV., *Clupeonia Commersonii* VALENC., LACEP. ibid. fig. 3; *Clupea Blochii, Clupea sinensis* BLOCH, *Ichth.* Tab. 405.

Kowala VALENC. Teeth in jaws and in pterygoid bones.

Sp. *Clupea Kowal* RUSSELL, *Corom. Fish.* Pl. 86, cited by VALENC., SCHLEGEL *Faun. Japon., Pisc.* Pl. 107, fig. 1.

Meletta VALENC. Teeth in tongue only. Branchiostegous membrane with 7 rays, more rarely with 6.

Clupea meletta, Meletta vulgaris VALENC., CUV. *et* VAL. *Poiss.* XX. Pl. 603; —*Clupea thrissa* auctor (not L.), *Chatoessus* CUV., BROUSSON, l. l. Tab. 10; in this species the last ray of the dorsal fin forms a long thread; it is found on the coasts of America.

Alosa CUV. Teeth either none, or small, deciduous in jaws alone. Upper jaw emarginate in the middle. Branchiostegous membrane with 8 rays.

Sp. *Clupea Alosa* L., *Alausa vulgaris* VALENC., YARR. *Brit. Fish.* II. p. 136, CUV. *et* VAL. *Poiss.* XX. Pl. 604; the *shad, l'alose;* this fish lives in the North Sea and the Mediterranean, and belongs to the species which, at a certain time of the year, come into fresh water. Thus, in April it is not rare in the mouth of our rivers, and at Rotterdam, for instance, is commonly known. The *Clupea finta* CUV., *Clupea fallax* LACEP., is, according to VALENCIENNES, by no means to be regarded as a distinct species.—There

are about twenty foreign species of this sub-genus, partly in the East Indies, at China and Japan, partly in the Western hemisphere.

†† *Supramaxillary bone behind the intermaxillary inserted into the œthmoid bone produced. Jaws equal, with snout tumid above the mouth.*

Chatoessus VALENC. (CUV. in part). Teeth none. Branchiostegous membrane with 6 rays. Last ray of dorsal fin produced in many into a long seta.

Sp. *Clupea nasus* BLOCH, *Ichth.* Tab. 427, *Peddah-Kome* RUSSELL, from Pondicherry;—*Chatoessus Cepedianus, Megalops Cepedianus* LESUEUR, CUV. *et* VAL. *Poiss.* XX. Pl. 612; on the coasts of N. America, &c.

Engraulis CUV. Æthmoid bone produced beyond the mouth. Gape of mouth very ample, produced behind the eyes, with long supramaxillary bones. Vomer, palatine and pterygoid bones mostly rough or armed with very small teeth. Maxillary teeth very small, sometimes none. Branchial aperture very ample; branchiostegous membrane with 9—14 rays. Scales thin, often deciduous. Abdomen in some rotund, in others carinate, serrate.

Sp. *Engraulis encrasicholus* CUV., *Clupea Encrasicholus* L., BLOCH *Ichth.* Tab. 30, fig. 2, YARR. *Brit. Fish.* II. p. 140, the *anchovy, l'anchois,* in the Mediterranean and North Sea; there are 12 or 13 rays in the gill-membrane, 15—17 rays in the pectoral, and 7 in the ventral fin; the length is mostly from 5″ to 6″.

In some species (the sub-genus *Thryssa* CUV.) the upper jawbones are produced into free, long threads. In these the abdomen is furnished with a sharp serrated margin. Sp. *Engraulis setirostris, Clupea setirostris,* BROUSSON, *Ichth.* Tab. XI.; from the South Pacific and Indian Ocean.

Coilia GRAY, *Trichosoma* SWAINS.

Exotic fishes, related to the preceding genus; with setæ elongate, free over the pectoral fins.

Odontognathus LAC., *Gnathobolus* SCHN. Body elongate, compressed, covered with deciduous scales, with abdomen serrate. Supramaxillary bones elongate, cuspidate. Maxillary teeth small, conical. Branchiostegous membrane with six rays. Ventral fins none. Dorsal fin small, remote; anal fin very long, depressed.

Sp. *Odontognathus aculeatus* LACEP. *Poiss.* II. Pl. 7, fig. 2, CUV. *et* VAL. *Poiss.* XXI. Pl. 611; from the West Indies. This genus differs little from *Engraulis,* except in the absence of the ventral fins.

Family XXI. *Heteropygii.* Upper margin of mouth formed principally by the intermaxillary bone. Teeth acute, small in jaws and palate, none in vomer and tongue. Body scaly. Head naked. Dorsal fin remote, opposite to anal. Vent in front of pectoral fins behind gills. Ventral fins small. Aperture of gills small. Pseudobranchiæ none. Swimming-bladder furnished with a duct to the œsophagus.

Amblyopsis DEKAY. (Characters of family.) Branchiostegous membrane with six rays. Two very small black points at the sides of head, instead of eyes.

Sp. *Amblyopsis spelæus.* A small fish from the United States of America, first described by DEKAY in the *Fauna of New York,* with which I am not acquainted. It lives in a subterranean grotto in Kentucky, and is—like other animals removed from the light—whitish or colourless. DEKAY placed this genus with the *Siluroidei,* from which however it differs by the scaly body. There are two small pyloric appendages; nevertheless, I think that this genus is best placed in the neighbourhood of the *Cyprinodontes.* It differs from all the other *Malacopterygii abdominales* in the position of the vent. See WYMAN *Descr. of a Blind Fish,* &c. *Annals of Nat. Hist.* XII. 1843, pp. 288, 299 (from SILLIMAN'S *American Journal,* 1843), and TELLKAMPF in MUELLER'S *Archiv,* 1844, s. 381—394, Taf. IX.

II. *Malacopterygii apodes.* Ventral fins none. Body elongate, skin thick and soft, with scales often small hidden in the skin. Swimming-bladder in most, either furnished with a duct or closed.

Family XXII. *Gymnotini.* Pectoral belt affixed to cranium. Upper margin of mouth formed in the middle by the intermaxillary bones, at the sides by the small supramaxillaries. Teeth mostly subulate or conical, small, in the intermaxillary bone and in lower jaw; some similar teeth in the fore part of vomer and in the symphysis of lower jaw. Branchial aperture in front of pectoral fins. Ovaries furnished with duct. Swimming bladder open by a duct into the œsophagus, double in many. Pyloric appendages.

* Dorsal fin.

Gymnarchus. CUV. Dorsal fin longitudinal. Tail towards the finless apex acuminate. Head naked; body scaly.

Sp. *Gymnarchus niloticus* CUV. *R. Ani.,* 2e édit. Pl. 13, fig. 3. A representation of the skeleton is given by J. HYRTL *Denkschr. der mathem. natur. Classe der Kaiserl. Akad. der Wissensch. zu Wien,* 1856. Compare FOERG *Remarques sur l'appareil pulmonaire du Gymnarchus niloticus, Ann. des Sc. nat.* 3e Série, XX. 1853, pp. 151, 162, Pl. 5, and HYRTL, l. l.

** Dorsal fin none.

Sternarchus SCHN. Body compressed, scaly; head naked. Caudal fin distinct, separated by an interval from anal. Anal fin beginning from throat, with vent placed under the throat. Membranous cirrus in back, affixed by tendinous filaments.

Sp. *Sternarchus albifrons* SCHN., *Gymnotus albifrons* L., PALL. *Spicil. Zool.* VII. Tab. VI. fig. 1;—*Sternarchus oxyrhynchus* MUELL. and TROSCH. *Hor. Ichth.* III. Tab. 2; in South America, like all the species of this family. There are two groups of conical teeth in the intermaxillary bone, and two rows of similar teeth in the lower jaw.

Carapus CUV. Body depressed, scaly; head naked. Anal fin produced as far as the apex of tail, attenuated, and without distinct caudal fin.

Sp. *Carapus Carapo, Gymnotus Carapo* L., BLOCH *Ichth.*, Tab. 157, fig. 2; &c.

Carapus rostratus, Gymnotus rostratus L., BLOCH *Syst. Ichth.* Tab. 106; the mouth is without teeth, at the end of an elongated snout, narrow at its termination. MUELLER and TROSCHEL form from this species the sub-genus *Rhamphichthys*. There are only three rays in the gill-membrane, whilst the other species have five.

Gymnotus CUV. (spec. of *Gymnotus* L.). Body round, with indistinct scales. Tail truncate, with caudal fin conjoined with anal.

Sp. *Gymnotus electricus* L., BLOCH *Ichth.* Tab. 156, CUV. *R. Ani., éd. ill., Poiss.* Pl. 110, fig. 1; the *electrical eel, l'Anguille electrique.* This species lives in fresh water, in ponds, &c. in South America, and attains the considerable length of more than five feet. The electric organs comprise two larger above, and two smaller below, and are situated on each side of the body, occupying about three-fourths of its length; the large organs lie immediately under the skin, the inferior are covered by the muscles of the anal fin. The apparatus is formed by membranous, aponeurotic partitions, which run in the length of the body almost parallel to each other, and between which extremely fine transverse plates are situated, thus forming small chambers filled with fluid. The nerves which run to the electric organs are not here, as in *Torpedo* and *Malapterurus* (see above, pp. 64, 89), branches of cerebral nerves, but branches of spinal nerves, of more than two hundred pairs of nerves, which for the most part also give branches to the swimming-bladder. The shocks are subject to the will of the animal; by repetition of them the fish loses for a time the electric power; hence, in order to capture these electric eels more easily, wild horses are sometimes driven into the water, and exposed to their first attacks.

Compare J. N. S. ALLAMAND *Verhandelingen van de Haarl. Maatschappij*, II. 1755, bl. 352—379;—J. HUNTER *An Account of the Gymnotus electricus, Phil. Trans.* Vol. 65, Part 2, 1775, pp. 395—407, or in the collection published by R. OWEN, of his *Observations on certain parts of the*

Animal Economy, 1837, pp. 415—421, Pl. 56, 57; G. VALENTIN, *Beiträge zur Anatomie des Zitteraales*, Neuchatel, 1841, 4to, (*Aus dem* VIIIten *Bde der Neuen Denkschriften der allg. Schweizer. Gesellsch. f. Naturwissenschaften,*) and in WAGNER'S *Handwörterbuch der Physiol.* I. s. 266, 273.

See also, especially on the mode of capture of Gymnotus to which we have alluded, HUMBOLDT in his *Recueil d'Observat. de Zool. et d'Anat. comp.* I. pp. 83—148, *Reise in die Æquinoctial Gegenden*, III. s. 294—324. Physical and chemical experiments with *Gymnotus* were performed especially by FARADAY some years ago; *Philos. Transact.* for 1839, Part I. p. 1, and following.

Family XXIII. *Symbranchii.* Pectoral belt annexed behind the head to the spinal column. Upper margin of mouth formed by intermaxillary bones descending to the angle of mouth, the supramaxillaries being placed next to them. Teeth in jaws and bones of palate. Branchial aperture single under the throat. Ovaries supplied with duct. Intestinal tract straight, and without pyloric appendages. Swimming-bladder none, at least in most.

Monopterus. COMMERSON. Common branchial aperture transverse, divided by a septum. Teeth very small, subulate, crowded in jaws and palate. Lips fleshy, expanded beyond the margin of jaw. Pectoral fins none. Dorsal and anal fins remote, confluent at the apex of tail. (Branchiostegous membrane with six rays; only three pairs of branchiæ.) Posterior orifice of nostrils above the eye, anterior below the eye.

Sp. *Monopterus javanensis* COMMERS., LACEP. The *Rijk's Museum* possesses specimens of this genus from Java and Borneo, up to 2′ feet in length.

Amphipnous MUELL. Common branchial aperture divided by a septum. Head narrowed in front of eyes, obtuse at the apex. Posterior aperture of nostrils above the eyes, anterior at apex of snout. First and fourth branchial arch without branchiæ. Two small bladders, respiratory, open into the mouth in front of first branchial arch. Body finless; tail compressed, with a sharp edge above and below, acuminate.

Sp. *Amphipnous cuchia, Unibranchapertura cuchia,* BUCHANAN *Fishes of the Ganges*, Pl. 16, fig. 4, pp. 16, 17. The respiratory sacs receive blood from the branchial arteries of the second and third branchial arch, and send their veins to the aorta; two of the arches of the branchial arteries go immediately into the aorta. TAYLOR in *Edinb. Journal of Science*, V. 1831, pp. 42—49.

Symbranchus (*Synbranchus* BLOCH), *Unibranchapertura* LACEP. Common branchial aperture, transverse or oval, not divided by a septum. Orifice of nostrils (single on both sides) above the eye. Dorsal and anal fins remote, confluent at the apex of tail. (Branchiostegous membrane with six rays. Teeth obtuse.)

Sp. *Symbranchus marmoratus* BLOCH, *Ichth.* Tab. 418, from Surinam, &c.

Alabes CUV.

NOTE.—Genus unknown to me. The characters of *Symbranchus*, from which it differs in having pectoral fins, and only 3 rays of branchiostegous membrane.

Family XXIV. *Muræoidei.* Pectoral belt annexed to spinal column behind the head. Superior margin of mouth formed by intermaxillary bones alone; rudiment of supramaxillary bone covered by muscles. Pyloric appendages none. Swimming-bladder furnished with *retia mirabilia* of vessels and with duct. Ovaries without oviduct.

Sphagebranchus BL. Apertures of branchiæ approximate under the throat. Pectoral fins small or none. Dorsal fin remote; sometimes no fins. Eyes often very small.

Sp. *Sphagebranchus rostratus* BLOCH, *Ichth.* Tab. 419, *Syst. Ichth.* Tab. 103, fig. 2; this species has no pectoral fins, neither has the East Indian species described by VAHL under the name of *Cæcula pterygera; Skrivter of natur. Selskabet*, III. 2, 1794, Tab. 13, figs. 1, 2.

There is a species which is also destitute of both dorsal and anal fin, consequently is entirely without fins. From this DUMÉRIL forms his genus *Apterichthus. Muræna cæca* L., LA ROCHE *Ann. du Mus.* XIII. Pl. 21, fig. 6. The small eyes are concealed beneath the skin; this fish lives in the Mediterranean Sea.

Saccopharynx MITCHILL, *Ophiognathus* HARWOOD. Body compressed, with abdominal sac ample, terminated by a long filiform tail. Anal and dorsal fins depressed, longitudinal. Pectoral fins small. Branchial aperture gaping forwards under pectoral fins. Gape of mouth large. Eyes small, placed at the extremity of upper jaw.

Sp. *Ophiognathus ampullaceus* HARWOOD *Philos. Transact.* for 1827, Part 1. pp. 49—57, Pl. 7. This singular fish is taken in the Atlantic Ocean. The size of the specimen described by HARWOOD was 4½ feet; there was a single row of teeth, pointed and bent backwards in both jaws. Compare also MITCHILL, *Description of an extraordinary fish, Annals of the Lyceum of New York*, I. 1824, pp. 82—86.

Anguilla THUNB. (spec. of *Muræna* L.). Teeth subulate in jaws in a narrow belt and in anterior part of vomer. Opercular bones small, surrounded by numerous incurved, slender rays of the branchiostegous membrane. Branchial apertures at the base of pectoral fins. Anterior orifice of nostrils tubular, in the apex of snout. Dorsal and anal fins produced to the apex of tail, and confluent.

Anguilla CUV. Dorsal fin commencing at half the interval between head and the beginning of anal fin.

Sp. *Anguilla vulgaris* FLEMING, *Muræna anguilla* L., BLOCH *Ichth.* Tab. 73; the *common eel, l'Anguille, der Aal;* the under jaw is longer than the upper. This fish is generally known, and becomes 2 or 3 feet long. There are several varieties (or species according to some writers), which have been described under distinct names, and have been observed amongst us; we record only *Anguilla acutirostris* YARRELL, *Brit. Fish.* II. p. 284, *Anguilla latirostris* YARRELL, l. l. p. 298; the figure of BLOCH, cited above, belongs to *Anguilla acutirostris.* Both Norwegian and English naturalists have observed the young eels in the Spring to ascend in the mouths of rivers in large troops, even by day, at which time the full-grown eels, as is well known, keep themselves concealed. Although no direct observations on the propagation of eels are yet known, it is nevertheless very improbable that they should be viviparous; sometimes intestinal worms have been mistaken for embryos; compare CREPLIN in *Archiv f. Naturgeschichte,* VII. 1841, s. 230—233.

On the generation of the eel see H. RATHKE *Bemerkungen ueber einen hochträchtigen Aal,* MUELLER'S *Archiv,* 1850, pp. 203—206.

Conger CUV. Dorsal fin beginning above pectoral fins. (Upper jaw protracted beyond the lower.)

Sp. *Conger vulgaris, Muræna conger* L., BLOCH *Ichth.* Tab. 155, YARRELL *Brit. Fishes,* II. p. 304; *conger-eel;* the dorsal fin is edged with black, and extends close to the pectoral fins; the lateral line is dotted white. This fish becomes 6 feet long. Specimens have been recorded of even 10 feet in length.

Muræna THUNB., *Gymnothorax* BLOCH, *Muræenophis* LACEP. (Species from genus *Muræna* L.). Teeth in jaws in one or more rows, sometimes crowded; teeth in vomer, often large, conical, sometimes in a single longitudinal row, in the middle of bone. Opercular bones small, surrounded by circular rays of the branchiostegous membrane, very thin, concealed under the skin. Apertures of branchiæ small, lateral. Pectoral fins none.

On the teeth of the different species of this genus compare CUV. *R. Ani.* 2, pp. 351, 352 (sec. édit.) and OWEN *Odontography,* pp. 164—166, Pl. 56.

Sp. *Muræna Helena* L., BLOCH *Ichth.*, CUV. *R. Ani., éd. ill., Poiss.* Pl. 109, fig. 2. A figure of the skeleton is to be found in ROSENTHAL *Ichthyot.*

Tafeln, Tab. 23. The Romans kept these fishes, which were highly esteemed by them, in stews. Of VEDIUS POLLIO it is related that he cast his condemned slaves to these fishes; PLINIUS *Hist. nat.* Lib. XI. c. 23; compare SENECA *de Ira*, Lib. III. cap. 40.

Uropterygius RUEPPELL. Teeth in jaws acute, conical, in a double row. Solitary conical tooth in vomer. Caudal fin small, as if formed by the confluence of dorsal and anal fins.

Ophisurus LAC. Dorsal and anal fins not produced as far as the apex of tail; apex of tail subulate. (Remaining characters almost those of *Anguillæ*, but some species approach the *Muræniæ* by their small pectoral fins, scarcely distinguishable.)

Sp. *Ophisurus colubrinus*, *Muræna colubrina* GMEL., LACEP. *Poiss.* v. Pl. 19, fig. 1;—*Muræna ophis* L.;—*Muræna serpens* L. &c.

Tribranchus PETERS.

Leptocephalus GRONOV., PENNANT. Body compressed, sub-pellucid. Head very small, acuminate. Teeth very minute. Pectoral fins very small, placed behind the branchial aperture. Dorsal and anal fins longitudinal, confluent with one another at the tail.

Sp. *Leptocephalus Morrisii* PENN., GRONOV. *Zoophylac.* I. Tab. 13, fig. 3, LACEP. *Poiss.* II. Pl. III. fig. 2, YARRELL *Brit. Fishes*, II. p. 311; in the North Sea and Mediterranean.

Family XXV. *Ophidini*. Swimming-bladder either closed and without pneumatic duct, or none. Pyloric appendages mostly none. Pseudobranchiæ pectinate. Ovaries furnished with oviduct.

Ammodytes L. Body elongate, covered with very small scales. Head compressed, acuminate; lower jaw produced beyond upper. Teeth none. Branchiostegous membrane with six or seven slender, setaceous rays. Dorsal and anal fins long, depressed, produced nearly to the distinct, forked caudal fin.

Sp. *Ammodytes Tobianus* L., BLOCH *Ichth.* Tab. 75, fig. 2, *Skandinaviens Fiskar*, Pl. 54; the *sand-eel*; (compare above, p. 53). RAY and LINNÆUS were of opinion that two species occur on the coasts of Europe. The accurate discrimination of the two is principally due to LESAUVAGE. The other species is named by CUVIER *Ammodytes lancea*; it continues smaller than the preceding, has the under jaw less projecting, and a dorsal fin which is prolonged more forwards, to above the pectoral

fins. *Sandlaunce;* a figure is to be found in YARRELL *British Fishes*, II. p. 322.

The ovary is single, but divided by a partition; the oviduct is wide, and more to the left side, inserted in the ovary almost at a right angle; an appendage of the ovary extends behind the vent into the tail. See RATHKE in MUELLER'S *Archiv f. d. Physiol.* VI. s. 597, 598.

The position of this genus in a natural arrangement is doubtful. It has no agreement however with the preceding family except in the absence of ventral fins.

Ophidium L. Body oblong, ensiform, covered with small scales immersed in the skin. Small teeth in jaws, in vomer and palate. Dorsal and anal fins connate with caudal. Pectoral fins. Branchial aperture larger, with six or seven short rays.

Sp. *Ophidium barbatum* L., BLOCH *Ichth.* Tab. 159, fig. 1; four barbules below the under jaw. This species occurs in the Mediterranean Sea. The skeleton is remarkable for a bony apparatus at the first vertebra, which serves for fixing the swimming-bladder. It is figured in ROSENTHAL *Ichthyot. Tafeln*, Tab. 22, figs. 7, 8. Pyloric appendages are wanting in this genus, with the exception of *Ophidium blacodes*, where there are six; MUELLER *über den Bau u. die Grenzen der Ganoiden*, s. 61. The teeth in the jaws are like cards, and are placed in several rows close together; those of the palate are conical, short and roundish. These fishes form the transition to the *Gadoidei*, and in some degree to *Blennius*.

The absence of barbules distinguishes the sub-genus *Fierasfer* CUV. (*Ophidium imberbe* L.). Here belong the following sub-genera.

Machœrium RICHARDSON.

Compare *Annals of Nat. Hist.* XII. 1843, pp. 175—178, Tab. VI.

Echiodon THOMPSON.

Compare *Trans. of the Zool. Society*, II. 3, 1839, pp. 207, 212, Pl. 38.

Enchelyophis MUELL.

NOTE.—The single Species, from the Philippine Isles, *Enchelyophis vermicularis* MUELL., is unknown to me. Pectoral fins none. Vent placed forward, behind branchiæ. MUELLER *Ganoiden* l. l.

III. *Malacopterygii subbrachii.* Ventral fins placed under the pectoral or in front of them.

Family XXVI. *Gadoidei.* Body elongate, scaly; head symmetrical. Swimming-bladder without pneumatic duct. Pyloric appendages numerous.

Macrurus BLOCH, *Lepidoleprus* RISSO. Head and body covered with scales mostly carinate or spinose on the posterior margin. Snout produced over the mouth; mouth inferior. Numerous small teeth in intermaxillary bone and lower jaw; lingual and palatine teeth none. Cirrus under chin. Branchiostegous membrane with six rays. Ventral fins placed under pectoral. Dorsal fins two, second very long, confluent at the point of the acuminate tail with anal.

Sp. *Macrurus Fabricii* SUNDEV., *Coryphæna rupestris* FABR., BLOCH *Ichth.* Tab. 177, from Greenland, with scales sharply carinate;—*Macrurus Stroemii* REINH., *Coryphænoides rupestris* GUNNERUS, with flat scales having fine spines at the posterior margin; on the coasts of Norway. A very similar species occurs in the Mediterranean Sea, *Lepidoleprus cœlorhynchus* RISSO, BONAP. *Faun. Ital.* III. Pl. 123, fig. 1.

In other species the snout is more prolonged and pointed; as in *Lepidoleprus trachyrhynchus* RISSO, *Ichth. de Nice*, Pl. 7, fig. 21, and a very similar species from Japan, *Macrurus japonicus* SCHLEGEL, *Faun. Japon. Pisc.* Tab. 112, fig. 2. These fishes appear to reside at great depths in the sea.

Compare on this genus SUNDEVALL *Kongl. Vetensk. Acad. Handlingar för* 1840, pp. 1—14 (transferred to OKEN'S *Isis*, 1845, s. 101—103).

Ateleopus SCHLEGEL. Scales inconspicuous or none. Head produced beyond the mouth, obtuse; mouth protractile, inferior. Teeth small, crowded in intermaxillary bone and lower jaw; teeth in palate and vomer none. Cirri none. Branchiostegous membrane with eight rays. Ventral fins placed in front of pectoral, consisting of a single cirrus formed of two rays intimately joined. Dorsal fin small above the pectoral fins. Anal fin very long, distinct from the small caudal.

Ateleopus Schlegelii nob., *Fauna Japonica, Pisc.* Tab. 112, fig. 2; the only known specimen of this rare Japan fish was 2′ 2″ long. The genus *Ateleopus* appears to stand between *Macrurus* and the sub-genus *Brotula* (under *Gadus*); of the internal structure nothing is known.

Gadus L. Head smooth. Body covered with scales mostly very small, circular, entire at the posterior margin. Teeth conical, numerous in intermaxillary bones, in lower jaw and in vomer. Branchiostegous membrane with seven rays. Ventral fins jugular, acuminate. Mostly several dorsal and anal fins.

A numerous genus of marine fishes, of which many species in northern countries constitute the chief food of man, and form when

dried or salted an important article of commerce. The capture of these fishes is for the people of some countries, as of Iceland, what the harvest is for the inhabitants of more temperate regions; their favourite food is the cod.

A. *Head broader than body, depressed.*

Raniceps Cuv. Dorsal fins two, first scarcely to be distinguished, second long; anal fin long. Ventral fins distant, with first and second rays elongate. Single cirrus of throat.

Sp. *Raniceps fuscus* Kroeyer, *Blennius fuscus* Stroem., *Gadus raninus* Bruennich, Mueller *Zool. Danica*, Tab. 45, *Skandinaviens Fiskar*, Tab. 21. This fish has only two rudimentary pyloric appendages, and differs more from the ordinary *Gadi* than the rest of the sub-genera. It lives in the North Sea, and also comes sometimes into the Baltic. *Gadus trifurcatus* Pennant (*Raniceps trifurcatus*, Yarrell *Brit. Fishes* II. p. 204), does not differ from this species, according to Fries and Kroeyer.

B. *Head not broader than body, compressed.*

† *Ventral fins uniradiate.*

Phycis Artedi. Dorsal fins two. Single gular cirrus. Head and body covered with thin scales (larger than in the other Gadoids).

Sp. *Phycis mediterraneus* Laroche, *Ann. du Mus.* XIII. pp. 332, 333, *Blennius phycis* L., Rondelet p. 186, Willughb. Tab. No. 12, fig. 3.

Phycis furcatus, Gadus furcatus Penn., Yarrell *Brit. Fishes*, II. p. 201; the ventral fins are not placed very close together.

Brotula Cuv. Dorsal and anal fins united with caudal. Cirri several, sometimes none. Ventral fins contiguous.

Sp. *Brotula barbata, Enchelyopus barbatus* Schn., *Syst. Ichth.* p. 52; a species from the West Indian Sea, figured by Parra, Pl. 31, fig. 2 (whose work (*Description de diferentes piesas de historia natural*, Havana, 1787, 8vo,) is known to me from citations alone. To this genus belong two species from Japan, *Brotula multibarbata* Schlegel, *Faun. Japonica, Pisces*, Tab. III. fig. 2, and *Brotula imberbis* Schlegel, ibid. fig. 3.

In *Brotula multibarbata* there are only two small pyloric appendages, as in *Raniceps*. *Faun. Japonica, Pisc.* p. 253.

Gadopsis nov. gen. Verany, Filippi.

Sp. *Oligopus ater* Risso. Compare *Ueber die Schwimmblase des Oligopus ater* Risso, *Aus einem Schreiben der Prof.* Filippi *in Turin an* A. Koelliker, *Zeitschr. f. wissensch. Zool.* VII. 1855, s. 170, 171.

†† *Ventral fins with several rays, mostly 5 or 6.*

a) *Dorsal fin single, long; anal fin single.*

Brosmius Cuv.

Sp. *Gadus brosme* Gmel., *Brosmius vulgaris* Cuv., Yarrell *Brit. Fishes*, II. p. 197.

b) *Dorsal fins two; anal fin single.*

Motella Cuv. First dorsal fin very low or rudimentary, inserted in a furrow. Ventral fins distant.

Sp. *Gadus Mustela* L., Bloch *Ichth.* Tab. 165, &c.

Lota Cuv. First dorsal fin exsert. Mental cirrus. Ventral fins distant.

Sp. *Gadus Lota* L., Bloch *Ichth.* Tab. 70; Cuv. *R. Ani., éd. ill., Poiss.* Pl. 106, fig. 3; the *eel-pout, burbot;* the only species of this family that ascends rivers and is taken in fresh water.

Merluccius Cuv. First dorsal fin exsert. Chin without cirrus. Teeth large, acute, disposed almost in a single row.

Sp. *Gadus Merluccius* L., Bloch *Ichth.* Tab. 164, *Skandinaviens Fiskar*, Pl. 33; the under jaw longer than the upper; the *hake.*

c) *Dorsal fins three, anal two. Mental cirrus single or none.*

Gadus Cuv. (with add. of genus *Merlangus* ejusd.)

Sp. *Gadus Merlangus* L., Bloch *Ichth.* Tab. 65, *Skandinaviens Fiskar*, Pl. 18; the *whiting;* without barbule; upper-jaws longer. *Gadus Æglefinus* L., Bloch *Ichth.* Tab. 62, *Skandinaviens Fiskar*, Pl. 19; the *haddock; Gadus* (*Callarias* and) *Morrhua* L., Bloch *Ichth.* Tab. 64, *Skandinaviens Fiskar*, Pl. 47; the *cod;* these species have a barbule at the lower jaw. (*Gadus Callarias* of authors is, according to Fries, Kroeyer and others, a name given to younger cod-fishes.) When dried this species (and *Gadus Merluccius* also) supplies the so-called stock-fish, when salted the Haberdine (salt-fish). The oil of the liver (*Oleum jecoris aselli*) *cod-liver oil* is much used, especially in glandular affections.

Family XXVII. *Pleuronectæ.* Body compressed, covered with scales small or moderate, mostly denticulate at the posterior margin. Head asymmetrical; both eyes placed on the same side. Branchiostegous membrane mostly with 7 rays. Dorsal and anal fins very long. Pectoral fins small, very often unequal, sometimes none. Swimming-bladder none.

The *soles* or *flat-fishes*, forming the genus *Pleuronectes* L., are marine fishes, which commonly keep in deep water; some species

occur also at times in fresh water. They are found in both hemispheres and in all climates. On account of their dentate scales AGASSIZ refers this family to the *Ctenoides*, which division, but for it, contains *Acanthopterygii* alone; but we must observe, that the rays of the dorsal and anal fins, although soft, are still mostly not split into threads. This family forms in fact the transition to the *Acanthopterygii*. In almost all the species there are 7 rays in the gill-membrane; *Pleuronectes limandoides* BLOCH has 8.

These fishes are distinguished especially by the position of the eyes on one side of the head; in some they lie on the right side, but in as great or perhaps even a greater number of species on the left. Sometimes varieties are observed in this respect, and the eyes lie on the opposite side to that on which they are usually placed in that species, which has been often seen in *Pleuronectes flesus* L., the *flounder;* nay, it has even been observed, that on both sides of the head an eye was placed, as in other vertebrate animals[1]. The side on which these eyes are placed is coloured, the other white; the side with the eyes is in some sense to be regarded as the back, and in swimming is turned upwards; often the jaws are more strongly developed on the opposite side, and the teeth larger; sometimes these last are entirely wanting on the upper side. On account of the great development of the tail the abdominal cavity is placed quite forward and is very small. The pectoral fins, which are of small service in swimming, are wanting in some, and are always little developed. The ventral fins also, which lie close together and are situated under the pectoral fins, always remain very small.

On the structure of these fishes interesting remarks may be found by AUTENRIETH in WIEDEMANN'S *Archiv fur Zoologie u. Zoot.* I, 1800, s. 57—130; skeletons are figured in ROSENTHAL *Ichthyot.* Taf. XI.

See P. J. VAN BENEDEN *Note sur la Symmétrie des Poissons pleuronectes dans leur jeune âge, Ann. des Sc. nat.* 3e Série, XX. pp. 340—342.

Pleuronectes QUENSEL, SUNDEV. Maxillæ apparent externally, not covered with scales. Superior maxillary bone with free, dilated apex. Opercula free above pectoral fins. Eyes moderate. Nostrils remote from jaws, placed on the blind side at the dorsal margin. Caudal fin always distinct, truncate or rounded.

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[1] In *Pleuronectes maximus;* see SCHLEEP, OKEN'S *Isis,* 1829, s. 1049—1053, Taf. III.

Rhombus CUV. Teeth minute, acute, in several rows. Dorsal fin commencing in head in front of eyes.

Sp. *Pleuronectes maximus* L., BLOCH *Ichth.* Tab. 49; the *turbot;* the eyes on the left side, which is coloured brown and beset with small tubercles. In some species the eyes, which are very large, are far asunder, as in *Pleuronectes rhomboides* BONAP., *Pleuronectes mancus* RISSO, BONAP. *Faun. Ital.* III. Tab. 99, fig. 1, from the Mediter. Sea, and *Rhombus myriaster* SCHLEG. *Faun. Japon.*, Tab. 92, fig. 2, from Japan.

Platessa CUV. Teeth in a single row, obtuse or subacute. Dorsal fin beginning over the upper eye. Interstice of eyes small. (Eyes mostly on the right side.)

Sp. *Pleuronectes Platessa* L., BLOCH *Ichth.* Tab. 42; the *plaise* or *plaice;* the brown-coloured right side with orange or red spots; between the eyes a stripe of six or seven tubercles;—*Pleuronectes Limanda* L., BLOCH *Ichth.* Tab. 46, the *dab,* &c.

Hippoglossus CUV. Teeth strong, acute, incurved, the anterior very large, arranged in multiple row. Interstice of eyes depressed, broad, with upper eye often placed almost at the ridge of back. (Body somewhat narrow, elongate.)

Sp. *Pleuronectes Hippoglossus* L., BLOCH, Tab. 47; the *holibut,* &c.

Solea QUENSEL, SUNDEV. Jaws concealed under the scaly skin, the upper rotund, the lower shorter. Mouth incurved. Teeth on lower side alone, thin, cylindrical, minute, in several rows. Branchial aperture below pectoral fins. Eyes small; lower eye placed behind the other, almost at the angle of mouth. Nostrils placed on both sides behind the maxillary margin. (Body oblong, narrowed towards tail; with caudal fin often confluent with dorsal and anal.).

Sp. *Solea vulgaris* GOTTSCHE, KROEYER, *Pleuronectes Solea* L., BLOCH *Ichth.*, Tab. 45, *Skandinaviens Fiskar,* Tab. 39; the *sole;* sometimes only six rays in the gill-membrane; eyes on the right side.

Add genera *Monochirus* CUV. (with pectoral fin on lower side none) and *Achirus* LAC. (with pectoral fins none).

ORDER X. *Acanthopterygii.*

Branchiæ pectinate, with narrow laciniæ. Supramaxillary bones not connate with intermaxillary. Rays supporting the anterior part of dorsal and anal fins inarticulate, mostly hard, strong, acuminate at the apex.

Spine-finned. This order of fishes is the most numerous of all. The scales are in most furnished with fine spines or points at the posterior margin (*Ctenoides* AGASSIZ). The ventral fins have commonly a hard pointed ray, like the first rays of the dorsal and anal fins; they are placed in almost all under or in front of the pectoral fins, and only in few behind these, as is the case in so many malacopterygians.

† *Lower pharyngeal bone unpaired.* (*Pharyngognathi acanthopterygii* MUELL.)

Family XXVIII. *Chromides.* Pharyngeal bone divided by a longitudinal suture into two lateral portions. Dorsal fin single. Ventral fins placed under pectorals. Scales almost always ctenoid, often large. Fleshy lips duplicate. Branchiostegous membrane with five rays. Pseudobranchiæ none.

Etroplus. Teeth of jaws arranged in a double row with acute margin exsert or tripartite. Anal fin with several (11—13) pungent rays.

Sp. *Etroplus coruchi* CUV. *et* VAL. *Poiss.* v. Pl. 136;—*Etroplus maculatus* CUV., *Chætodon maculatus* BLOCH, *Ichth.* Tab. 427; East Indian fresh-water fishes, which were placed by CUVIER in the family of the *Sciænoids* with *Glyphisodon* LAC.

Chromis CUV. (in part) *Acara, Heros, Geophagus, Chætobranchus* HECK. Body compressed. Teeth of jaws thin, conical, crowded, forming a band, with front row somewhat larger. Lateral line interrupted, anterior part convex, parallel to back, posterior straight in the middle of tail. Dorsal, anal and ventral fins acuminate, with some rays produced into filaments.

Sp. *Chromis niloticus* CUV., *Labrus niloticus* HASSELQ., *Iter Palæst.* p. 346. SONNINI *Voyage en Egypte*, Pl. 27, fig. 1; this fish, named *Bulti* or *Bolti*, is, according to HASSELQUIST, the best in the Nile, and reaches a size of 2′. The head is broad and thick. This species has *cycloid* scales, whilst in the other species they are *ctenoid*. This *Chromis*, or another nearly allied species, occurs also in South Africa: *Tilapia Sparmanni* SMITH; comp. J. MUELLER in ERICHSON'S *Archiv f. Naturgesch.* 1843, pp. 381, 382.

Chromis Gronovii, Acara Gronovii HECK., *Labrus bruneus* GRONOV. *Mus. Ichth.* p. 36, *Zoophylac.* Tab. v. fig. 4, (probably not specifically different from *Labrus punctatus* L., BLOCH *Ichth.* Tab. 295, fig. 1) from Surinam; the head and the anterior part of the back very thick and round.

Here belong different species of S. American fresh-water fishes, on which compare HECKEL *Ann. des Wiener Museums*, II. 1840, s. 337—407.

Here also belong the genera *Uaru, Symphysodon, Pterophyllum* and *Batrachops* of the same writer.

Cichla BL., SCHN. (excl. of some species). Maxillary teeth small, thin, crowded, forming a broad band, with no front row of larger teeth. Body oblong. Scales small. Lateral line abruptly deflected, or interrupted.

a) With præoperculum entire. *Cichla* HECK. *Habitus* of *Perca*.

Sp. *Cichla brasiliensis, Perca brasiliensis,* BLOCH *Ichth.* Tab. 310, fig. 2, &c.

b) With præoperculum denticulate. *Crenicichla* HECK. *Habitus* of *Esox*.

Sp. *Cichla saxatilis, Sparus saxatilis* L., GRONOV. *Mus. Ichth.* 2, p. 29, ibid. and *Zoophl.* Tab. VI. fig. 8; a brown stripe behind the eye above the operculum, and a black oval spot bordered with white in front of the caudal fin; from Surinam.

Family XXIX. *Pomacentrini.* Inferior pharyngeal bone unpaired, without longitudinal suture, with teeth conical or subulate, acute. Dorsal fin single. Ventral fins placed under pectorals. Scales large, ctenoid. Rays of branchiostegous membrane 4—6. Pseudobranchiæ. Lateral line convex, ending at the termination of dorsal fin.

This family, which contains marine fishes alone, whilst the preceding consists of river-fishes, is also distinguished by the absence of lips or folds of skin around the jaws. CUVIER referred the genera belonging to it to the *Sciænoids;* HECKEL first pointed out their affinity with the *Labroids, Ann. des Wiener Museums,* II. p. 330. By far the greatest number of species belong to the Indian seas. Comp. H. SCHLEGEL and S. MUELLER in *Verhandelingen over de Natuurlijke Geschiedenis der Nederlandsche Overzeesche Bezittingen; Vischen,* l. l. 17—25.

Most of the species are striped with broad bands across the body, of a white or darker colour, strongly contrasting with the ground-colour, which in the first case is blackish, in the other white. They are all small, or only of moderate size.

1) *Several rows of maxillary teeth.*

Heliases CUV. Teeth thin, conical, those of front row larger than the rest. Body compressed, broad. Præoperculum with margin entire. Branchiostegous membrane with five rays. Ventral fins acuminate. Caudal fin forked.

Sp. *Heliases insolatus* CUV. *et* VAL. *Poiss.* V. Pl. 137, from the Antilles, one of the few species of this family from the W. Hemisphere;—*Heliaces cinerascens* CUV. *et* VAL., SCHLEG. and S. MUELLER l. l. Pl. 6, fig. 5, from Java, &c.

To this genus belongs also, according to HECKEL, *Sparus chromis* L., *Chromis castanea* CUV., *Heliases chromis* nob., RONDELET *De Piscibus*, p. 152, CUV. *R. Ani., éd. ill., Poiss.* Pl. 90, fig. 1; a small fish, of dark brown or black colour, found in the Mediterranean Sea. Since this species was the first that caused CUVIER to form the genus *Chromis* (*Mém. du Mus.* I. p. 353) HECKEL would allow it to retain the name *Chromis*.

Dascyllus CUV. Teeth conical, numerous. Body compressed, broad. Præoperculum denticulate. Branchiostegous membrane with five or six rays. Caudal fin bilobed.

Sp. *Dascyllus aruanus, Chætodon aruanus* L. *Mus. Adolphi Frider.* Tab. 33, fig. 8, BLOCH *Ichth.* Tab. 198, fig. 2;—*Dascyllus niger* BLEEKER, *Pomacentrus trimaculatus* RUEPPEL, from the Red and Indian Seas, &c.

2) *Single row of maxillary teeth.*

Glyphisodon LAC. Teeth equal, with margin acute, often exsert. Branchiostegous membrane with six rays. Præoperculum with margin entire. Caudal fin forked or bilobed.

Sp. *Glyphisodon cœlestinus* CUV., *Labrus sexfasciatus* LAC. *Poiss.* III. Pl. 19, fig. 2, CUV. *et* VAL., *Poiss.* V. Pl. 135; from the Indian Sea and Southern Pacific; with numerous other species from the eastern and some from the western hemisphere.

Pomacentrus LACEP. (excl. of species), CUV. Teeth small. Branchiostegous membrane with four rays. Præoperculum denticulate. Operculum entire. Caudal fin excised, or bifurcate.

Sp. *Pomacentrus pavo* LAC., CUV., *Chætodon pavo* BLOCH, *Ichth.* Tab. 198, fig. 1. CUV. *R. Ani., éd. ill., Poiss.* Pl. 32, fig. 3; from the Indian Sea, &c.

Premnas CUV. Teeth obtuse. Præoperculum denticulate. Suborbital bone with one spine or two directed backwards. Branchiostegous membrane with six rays. Caudal fin rounded.

Sp. *Premnas trifasciatus* CUV., *Chætodon biaculeatus* BLOCH, *Ichth.* Tab. 219, fig. 2, SCHLEG. and S. MUELLER l. l. Tab. 5, fig. 5; *Premnas semicinctus* CUV. *et* VAL. *Poiss.* V. Pl. 133, fig. 1; both from the Indian Sea at the Sunda Isles.

Amphiprion BL., SCHN. (excl. of several species). Teeth conical, obtuse, small. Operculum, suboperculum and præoperculum striate, with margin serrate. Branchiostegous membrane with five rays. Caudal fin rounded.

Sp. *Amphiprion ephippium* SCHN., CUV., *Lutjanus Ephippium* BLOCH *Ichth.* Tab. 250, fig. 2, at Java;—*Amphiprion percula* CUV., BLOCH *Ichth.* Tab. 316, fig. 3; at Java, Sumatra and Celebes, &c.

Family XXX. *Labroidei.* Lower pharyngeal bone unpaired and without longitudinal suture; pharyngeal teeth globose, thick or lamellose, oval, tranverse, placed in transverse rows. Mouth with fleshy lips. Dorsal fin single, supported anteriorly by spines, posteriorly by split rays, the spines often increased by a filiform appendage. Ventral fins placed under pectorals. Body oblong, covered with cycloid scales. Pseudobranchiæ. Branchiostegous membrane with five rays, in few with six.

Lip-fishes. As the *Pleuronectæ* are soft-finned fishes, which belong to the *Ctenolepidoti*, so this family with some others forms an exception amongst the spine-finned fishes, which usually have toothed or spined scales, and is provided with smooth-margined (cycloid) scales. A primary character, which also occurs in the two preceding families, consists in the unpaired inferior *os pharyngeale;* but from both the preceding the present family is distinguished by the large, blunt teeth which cover that bone as well as the upper *ossa pharyngealia* in form of a pavement. (See the bones figured in *Scarus*, OWEN'S *Odontography*, Pl. 51.)

The fourth branchial arch has branchial leaflets on the fore side alone; the fourth gill is thus only a half gill (see above, p. 33). All the fishes of this family live in the sea.

Near the *Labroidei* seems to be the place for some new species of fishes from San Francisco, *Hollonoti.* Comp. GIBBONS and GIRARD *Archiv für Naturgesch.* XXI. 1 (1855) s. 331—341, 342—354.

Scarus FORSK., GMEL. (excl. of some spec.). Jaws rather prominent, convex, covered with teeth grown together imbricately. Fleshy lips simple. Pharyngeal teeth transverse, vertical laminæ, arranged in lower pharyngeal bone in alternating rows. Body covered with large scales. Lateral line branched, interrupted.

Parrot-fish. The articular portion of the lower jaw (*os articulare*, p. 22) is connected with the anterior portion (the *os dentale*) by a joint, so that it has here a moveable connexion at both extremities, and not at the upper part alone, with the jugal bone (p. 21). In the dental piece there is a cavity on each side, which serves for the joint.

The species are very numerous, and we may reckon the species now known at about one hundred, of which a fourth part are at home around the *Sunda Isles* and in the Moluccan Archipelago. They keep principally upon the coral reefs.

Sp. *Scarus cretensis* RONDEL. (not BLOCH), *Labrus cretensis* L., ALDROVANDI *de Pisciь.* p. 7, fig. 4, GUÉRIN *Iconogr., Poiss.* Pl. 44, fig. 3; at one time coloured red, then blue again; this fish lives in the eastern parts of the Mediterranean Sea, and was highly esteemed by the ancients;—*Scarus Abildgaardi* VAL., *Scarus coccineus,* BLOCH *Ichth.* Tab. 259, LACEP. *Poiss.* III. Pl. 33, fig. 3, from the West Indies, &c. See on this genus especially CUV. *et* VALENC. *Poiss.* Tom. XIV. pp. 132—284; compare also P. BLEEKER *Overzigt der te Batavia voorkomende gladschubbige Labroieden, Verhandelingen van het Batav. Genootsch. van Kunsten en Wittensch.* XXII. Batavia, 1849, pp. 42—64.

Callyodon GRON., (in part) CUV. (*Calliodon*). Upper jaw with lateral teeth remote, acute, with an inner row of smaller teeth.

Sp. *Callyodon ustus* VALENC., GRONOV. *Mus. Ichth.* Tab. 7, fig. 4, CUV. *et* VAL. *Poiss.* Pl. 405;—*Calliodon japonicus* VAL., CUV. *et* VAL. Pl. 406, and better, *Fauna Japonica, Pisces,* Tab. 89.

Odax CUV.

Epibulus CUV. Teeth in jaws in a single row, the two intermediate above and below larger, exsert, the rest small. Mouth protractile, exsert, longer than head. Pharyngeal bones with conical teeth. Body compressed, covered with large scales. Lateral line interrupted.

Sp. *Epibulus insidiator* CUV., *Sparus insidiator* PALL. *Spicil. Zool.* VIII. pp. 41—44, Tab. V. fig. 1, (with snout protracted), CUV. *R. Ani., éd. ill., Poiss.* Pl. 88, fig. 2; *der Betrüger, le filou;* in the East Indies, at Java, Sumatra and the Molucca Islands. This fish captures other fishes almost in the same way that the larvæ of *libellulæ* overpower their prey (see above I. p. 421); it watches, without moving, until a small fish in its neighbourhood swims past, and then seizes it by very rapidly projecting the tube, at the extremity of which are the jaws. The intermaxillary bones have long pedicles which, when the snout is retracted, lie in grooves upon the skull, and when it is extended bound the margin of the tube at the upper side. The articular pieces of the lower jaw are long, and the jugal is a thin curved bone whose convex margin is turned forward; when the intermaxillary bones glide forwards, the jugal also is drawn forward and causes the under jaw to project.

Cheilinus LAC., CUV. Maxillary teeth conical; middle and inferior incurved, two middle and upper small, placed between two large, incurved, divaricate; lesser teeth in second row, behind the middle ones of both jaws. Pharyngeal teeth in some conical, in others cylindrical or sub-globose. Scales large. Lateral line interrupted.

Sp. *Cheilinus fasciatus* CUV., *Sparus fasciatus* BLOCH, *Ichth.* Tab. 257;—*Cheilinus trilobatus* LAC., *Poiss.,* III. Pl. 31, fig. 2, &c.; species from the Indian and Red Seas and the Pacific Ocean.

Xyrichthys CUV. Maxillary teeth conical, in a single row, with two larger, exsert, incurved in the middle of both jaws. Pharyngeal bones covered with globose teeth. Head truncato-declivous, with eyes approximate to the back, very remote from mouth. Body compressed, covered with scales mostly large. Lateral line interrupted. Branchiostegous membrane with six rays[1].

Sp. *Xyrichthys cultratus* VALENC., *Coryphæna Novacula* L., RONDELET *de Piscib.* p. 146, CUV. *et* VAL. *Poiss.* XIV. Pl. 391; in the Mediterranean Sea.—In some species the first three rays of the dorsal fin are placed much forward and separate from the rest. From the species with small scales under the eyes, on the *præoperculum*, VALENCIENNES forms the sub-genus *Novacula*. To this belong *Xyrichthys pentadactylus*, *Coryphæna pentadactyla* L. (*exl. syn.* WILLUGHB.), BLOCH *Ichth.* Tab. 173, CUV. *et* VAL. l. l. Pl. 395, from the Indian Sea, at Celebes.

Labrus L. (in part), CUV. (add *Crenilabrus* and *Coricus* ejusd.). Maxillary teeth conical, in a single row, or in front row, with lesser and crowded teeth forming a second row. Pharyngeal teeth cylindric, globose or conical. Upper lip duplicate, with skin folded transversely in front of suborbital bones. Cheeks and opercula scaly. Lateral line continuous.

Sp. *Labrus mixtus* L., *Labrus variegatus* GM., *Labrus vetula* BLOCH, *Ichth.* Tab. 293, male, *Labrus carneus* BLOCH, *Ichth.* Tab. 289, fem. (*Labrus trimaculatus* GMEL., VALENC.). All these names, to which probably *Labrus ossifragus* L. might be added, refer to one species, which occurs in the Mediterranean and in the North Sea, and of which the two sexes are marked very differently; see the figures of both in the celebrated work of FRIES, EKSTROEM and SUNDEVALL, *Skandinaviens Fiskar*, Pl. 37, 38. Probably this, like other northern species, occurs now and then on the Dutch coasts, although, as far as we know, it has not yet been observed. As found on our coasts we are alone able to record: *Labrus maculatus* BLOCH, *Labrus Berggylta* ASCAN., VALENC., BLOCH *Ichth.* Tab. 294, *Skandinav. Fisk.* Pl. 2; this is the largest of the northern species, and attains a length of 15". The lively colours of this, as of many other fishes, change rapidly after death, and in this respect the figures cited in the work on the fishes of Sweden are to be relied on in preference to all the rest, since they were always taken from living specimens. YARRELL describes 11 species of *Labrus* and *Crenilabrus* as frequenting the British coasts.

Crenilabrus CUV. Præoperculum denticulate. Mouth not protractile.

Coricus CUV. Præoperculum denticulate. Mouth protractile.

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[1] In *Tautoga* also BLEEKER found six gill-rays. All the other genera of this family appear to have five.

Gomphosus LAC. Head naked, narrowed anteriorly, with mouth small, terminal. Maxillary teeth in a single row, the two middle above and below larger. Lateral line continuous. Caudal fin truncate or lunate.

Sp. *Gomphosus cepedianus* QUOY *et* GAIMARD, *Voyage de* FREYCINET, *Zool.* Pl. 55, fig. 2, CUV. *et* VALENC. *Poiss.* XIV. Pl. 390; *snipe-fish*, RENARD, VALENTIJN; from the Moluccan Archipelago and the Southern Pacific; —*Gomphosus fuscus* VALENC., LACEP. *Poiss.* III. Pl. V. fig. 2;—*Gomphosus cæruleus* LACEP. *Poiss.* l. l. fig. 1.

Anampses CUV. Head naked. Only two teeth in each jaw, exsert, curved outwards, the upper broader. Lateral line continuous. Branchiostegous membrane with six rays.

Sp. *Anampses Cuvieri* QUOY *et* GAIM., *Voyage de* FREYCINET, Pl. 55, fig. 1. South Pacific;—*Anampses geographicus* VALENC., CUV. *et* VAL. *Poiss.* XIV. Pl. 389, from the Indian Ocean, at Celebes, &c. All the species are from the eastern hemisphere, but some from the Red Sea.

Julis CUV. Head naked. Maxillary teeth subulate, two or four middle above and below larger; lesser teeth in second row. Lateral line continuous, abruptly geniculate. Branchiostegous membrane with six rays. (Scales in some species small. Colours variegated, lively.)

Sp. *Julis vulgaris* VALENC., *Labrus julis* L., BLOCH *Ichth.* Tab. 387, fig. 1, CUV. *et* VAL. *Poiss.* XIII. Pl. 384; from the Mediterranean Sea;—*Julis hortulanus* VALENC., *Labrus centiquadrus* LAC. *Poiss.* III. Pl. 29, fig. 2; East Indies, at the Sunda Islands;—*Julis lunaris* VALENC., *Labrus lunaris* L., GRONOV. *Zoophyl.* I. Tab. VI. fig. 2, *Labrus zeylanicus* PENNANT, *Indian Zoology*, London, 1790, Tab. XVI. fig. 2, *Scarus Gallus* FORSK.; Red Sea, Indian Ocean, &c.

Most of the species of this numerous genus, (about 100 are known), which well deserves and requires a monograph, are from the Indian Ocean; there are, however, also some species from the western hemisphere.

†† Lower *Pharyngeal bones two, separate.* (Order of *Acanthopteri* MUELL.).

Family XXXI. *Aulostomi* (s. *Fistulares*). Body in some covered with scales denticulate on the posterior margin, in some with scaleless skin. Ventral fins placed in abdomen behind pectoral fins. Head elongated into a cylindric snout. Jaws at the apex of snout. Dorsal fin remote.

Pipe-snouted fishes. The production of the head in front of the eyes, resembling that of the head in *Syngnathus*, is formed by the length of the ethmoid bone and vomer and of the *præoperculum*. The jaw-bones are of the usual length. These fishes differ from almost all the other *Acanthopterygii* in this, that, according to the position of the ventral fins, they belong to the *abdominales* of LINNÆUS. They belong chiefly to the tropical seas. Some species of this family have been found fossil in the Monte-Bolca.

Centriscus L. Body oval or oblong, compressed, with abdomen carinate. Head produced into a very narrow snout, with mouth small. Dorsal fins two, very remote, the first with a strong anterior spine. Branchiostegous membrane with two or three rays.

Sp. *Centriscus Scolopax* L., BLOCH *Ichth.* Tab. 123, fig. 1, GUÉRIN *Iconogr., Poiss.* Pl. 45, fig. 2; from the Mediterranean Sea; the body is covered with small scales. In an East Indian species the body is more elongate and covered above or on the sides also with long thin scales, whilst the tail behind the first dorsal fin is bent downwards; this species is *Centriscus scutatus* L., GRONOV. *Mus.* I. Tab. VII. fig. 3, BLOCH l. l. fig. 2. From this is formed the genus *Amphisile* KLEIN, CUV.—*Centriscus velitaris* PALL., *Spic. Zool.* VIII. Tab. IV. fig. 8, makes in some sense the transition between these two forms. I have not seen this fish myself, yet from the figure of PALLAS, I am disposed rather to leave it with *Centriscus scolopax*, than to refer it to the sub-genus *Amphisile*.

Aulostomus LAC. Body elongate, covered with small scales. Mouth edentulous at the end of the compressed, obtuse tube. Short conical cirrus under the apex of lower jaw. Body higher at the very remote dorsal and anal fins, from thence attenuated into the short tail. Several separate spines in a furrow of back in front of dorsal fin. Caudal fin rounded. Branchiostegous membrane with four rays?

Sp. *Aulostomus chinensis* LAC., *Fistularia chinensis* L., BLOCH *Ichth.* Tab. 388; in the Indian and Chinese seas, also rarely at Japan. The specimens which I have seen of this fish had, with the exception of a small black spot at the base of the ventral fins and of two brown or black spots on the caudal fin, the body of one colour. BLOCH has drawn this fish with many spots.

A specimen coloured red, with a row of black spots on the belly and some similar spots on the tail, in the *Rijks-Museum* at Leyden, appears to agree with *Aulostoma maculatum* VALENC., CUV. *R. Ani., éd. ill., Poiss.*

Pl. 92, fig. 2, (in which figure, however, as in all with which I am acquainted, the barbule at the lower jaw is omitted). According to VALENCIENNES this species is from St Domingo.

Fistularia L. (in part). Body elongate, covered with naked skin. Snout compressed, very long; teeth small, subulate, few, in a single row in intermaxillary bone, in lower jaw and on both sides of palate. Lower jaw without cirrus. Dorsal fin single, short. Ventral fins small, distant. Caudal fin forked, with single or double very long terminal seta between the lobes. Branchiostegous membrane with six or seven rays.

Sp. *Fistularia tabacaria* L., *Mus. Adolph. Frider.* Tab. 26, fig. 1. BLOCH *Ichth.* Tab. 387, fig. 1; this has only one thread at the caudal fin (1); —*Fistularia serrata* BLOCH, ib. fig. 2; with two threads. Both species are from South America.

Fistularia immaculata COMMERS., J. WHITE *Journal of a Voyage to New South Wales*, Pl. 64, fig. 2; in the Indian Ocean and the South Pacific; common at Japan. The colour during life is brown-red; there is a single thread at the caudal fin.

Family XXXII. *Theutides.* Body compressed, scaly, oblong or oval. Scales small, smooth, mostly rough posteriorly with thin spines. Mouth small, with maxillary teeth in a single row; palatine teeth none. Dorsal fin single, long. Ventral fins thoracic. Caudal fin narrow at the base, ample towards the extremity, truncate or excised. Lateral line, parallel to back, curved at the commencement, posteriorly straight.

A small family of marine fishes from warm regions, all living on vegetable food. In the *habitus* they approach nearest to some *Scomberoïds*, as *Stromateus.*

† *Hard pungent rays in anal fin two or three. Skin rough, with scales very small, sometimes inconspicuous or none.*

Keris VALENC. Teeth subulate. Tail unarmed. Ventral fins jugular, with a single pungent ray and five soft.

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[1] Does this species also occur on the coast of Africa? The *Rijks-Museum* received a specimen from Guinea resembling in marking that of BLOCH. The species of this genus are not yet sufficiently distinguished.

Priodon Cuv. Teeth serrate. Tail unarmed. Branchiostegous membrane with three rays. Ventral fins with one ray pungent and three soft.

Sp. *Priodon annularis* Cuv., Cuv. *et* Val. *Poiss.* x. Pl. 294, Indian Sea at Timor.

Acanthurus Forsk., Lacep. Teeth serrate. Tail with a moveable sharp spine on each side, the apex directed forward, or armed with a row of compressed, carinate laminæ (*Prionurus* Lac.). Branchiostegous membrane with five rays. Ventral fins with single ray pungent and mostly with five soft.

Sp. *Acanthurus hepatus* Cuv., *Teuthis hepatus* L. (*excl. synon.* in part), Cuv. *et* Val. *Poissons*, x. Pl. 288;—*Acanthurus triostegus* Cuv., *Chætodon triostegus* L. (*omissa synon.* in part), Broussonet *Ichth.* Tab. 4, (and less good, Seba *Thesaur.* iii. Tab. 25, fig. 4, Lacep. *Poiss.* iv. Pl. 6, fig. 3), yellow-green with five black stripes; in the Indian and Pacific Ocean;—*Acanthurus chirurgus* Bl., Schn., *Chætodon chirurgus* Bloch, *Ichth.* Tab. 208, from the West Indies;—*Acanthurus Delisiani* Cuv., Val., Guérin *Iconogr., Poiss.* Pl. 35, fig. 2; Indian Ocean, from the island Mauritius to Ceylon, &c.

Prionurus microlepidotus Lac., Cuv. *et* Valenc. *Poiss.* x. Pl. 292; —*Prionurus scalprum*, *Acanthurus scalprum* Langsd., Schlegel *Faun. Japon., Pisc.* Tab. 70.

Naseus Commers., *Monoceros* Bloch, Schn. Teeth conical, in a single row. Scales scarcely conspicuous. Head often tumid in front of eyes or produced into a horn. Tail with two spines on each side, or with triangular lamellæ placed upon an oval scute. Branchiostegous membrane with four rays. Ventral fins with a single pungent ray and with only three soft rays.

Sp. *Naseus fronticornis* Commers., Willughb., *Hist. Pisc.*, Tab. O, 4; Guérin *Iconogr. Poiss.* Pl. 35, fig. 3, (under the name of *Naseus longirostris*); Red Sea, Indian Ocean, South Pacific;—*Naseus tuber* Commers., Lac. *Poiss.* iii. Pl. 7, fig. 3, &c.

Axinurus Cuv. Teeth thin. Tail armed on each side with a compressed, sharp, horizontal lamella. Head gibbous and without horn; mouth small. Branchiostegous membrane with five rays.

Sp. *Axinurus thynnoides* Cuv., Cuv. *et* Valenc. *Poiss.* x. Pl. 298; New Guinea.

The length of the intestinal canal is remarkable in these fishes. In a specimen of *Naseus fronticornis* of 10″ long, the intestinal canal was observed to be 4′ long; Cuv. *et* Val. *Poiss.* x. p. 268.

†† *Pungent rays in anal fin seven. Scales distinct, small or moderate, with posterior margin entire (cycloid).*

Amphacanthus BL., (*Seganus* FORSK. *Centrogaster* HOUTT[1]). Teeth small, in a single row in both jaws, emarginate at the apex or cuspidate. Ventral fins with two rays, external and internal, pungent, with three soft rays interposed. Tail unarmed.

Fishes from the eastern hemisphere which are distinguished, like *Etroplus* (see above, p. 130) and the genera *Centrarchus* CUV. and *Polyacanthus* V. HASS., by the numerous spinous rays of the anal fin; more characteristic still is the furnishing of the ventral fins with a spinous ray on the inside, a peculiarity which occurs in no other genus of fishes. The styliform bone of the belt of the pectoral fins, which is regarded as a coracoid bone (see above, p. 17), is strongly developed, and extends in an arch backwards to attach itself to the first inter-spinal bone of the anal fin[2]. A species from the Red Sea (*Amphacanthus luridus* EHRENB. or *Amphacanthus siganus* RUEPP.?) is named by the Arabs *Sidjan*, from which the generic name *Siganus* is borrowed.

Sp. *Amphacanthus javus* CUV., *Teuthis javus* L., *Hepatus* GRONOV. *Zoophyl.* I. Tab. 8, fig. 4; on the back dark-coloured, greenish, below grey, with yellow-white round spots on the back, which on the sides pass into elongated spots, and downwards into stripes;—*Amphacanthus guttatus* BL., SCHN., BLOCH *Ichth.* 196;—*Amphacanthus corallinus* CUV., VAL. *Verh. over de nat. Gesch. der Nederl. Bezittingen, Pisc.* Tab. 2. fig. 2, *Dictionn. univ. d'Hist. nat. Poiss.* Pl. 11, fig. 1;—*Amphac. marmoratus* QUOY *et* GAIM. *Voy. de l'Uranie,* Pl. 62, *Dict. class. d'Hist. nat.* Pl. 108, &c.

Family XXXIII. *Halibatrachi* s. *Chironectæ.* Bones of carpus elongate, forming a pedicle, sustaining pectoral fins. Body mostly scaleless, with head large. Ventral fins jugular. Branchiæ only three complete, with last arch naked or branchiferous on the anterior margin alone. Rays of branchiostegous membrane six.

Chironectes CUV. (*Antennarius* COMMERS.). Body compressed, naked. Three branchiæ with semibranchia. Branchial aperture narrow, rotund, behind pectoral fin. Three spinous rays above head, separate from dorsal fin, the dorsal supported by soft rays, commencing in back in front of anal fin, long.

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[1] M. HOUTTUYN described a couple of species of this genus under the name of *Centrogaster; Verhand. van de Holl. Maatsch. der Wetensch. te Haarlem,* XX. Dl. 2e Stuk, 1782, pp. 332—334.

[2] GEOFFROY SAINT-HILAIRE *Anat. philos.* I. p. 471, Pl. IX. fig. 108.

Comp. CUVIER *Sur le genre Chironecte; Mém. de Museum*, II. 1817, pp. 418—435, Pl. 16—18.

These fishes are on the whole small. They have a large swimming-bladder, and are able, by distending the stomach, to inflate their body. The pediculated pectoral fins and the ventral fins placed in front of them, resemble four feet, by means of which these fishes creep over the ground. The different species of them are found in the tropical seas, especially amongst forests of *Fucus natans*, which cover large tracts of the surface of the ocean.

Sp. *Chironectes pictus* VALENC., *Lophius histrio* L. in part, CUV. *et* VALENC. *Poiss.* XII. Pl. 364; Atlantic Ocean, West Indies;—*Chir. marmoratus* VALENC., SCHLEG. *Faun. Japon., Pisc.* Tab. 81, fig. 1: Indian Ocean, as far as the seas of China and Japan;—*Chir. punctatus* CUV., *Lophius hirsutus* LAC., CUV. *Mém.* l. l. Pl. 18, fig. 2, &c.

Chaunax LOWE.

Comp. *Transact. of Zool. Soc.* III. 4, 1846, p. 339, Pl. 51.

NOTE.—Does genus *Ceratias* KROEYER, unknown to me, belong here? Ventral fins none. Teeth conical, subincurved in intermaxillary bones and lower jaw; teeth in vomer and palate-bones none.

Sp. *Ceratias Holboelli*, from the Greenland Sea. Comp. KROEYER *Tidsskrift; ny Rackke*, I. 1845, p. 639.

Lophius L. (in part), CUV. Body naked, depressed. Head very large, depressed, rotundate. Branchial aperture small behind pectoral fins. Mouth very ample, with lower jaw produced beyond upper. Teeth subulate, unequal in jaws, vomer and palate-bones. Dorsal fins two, the first composed of separate rays, the three anterior remote forwards, placed on head, mobile; the second dorsal fin small, opposite to anal. Only three pairs of branchiæ, with last branchial arch naked.

Sp. *Lophius piscatorius* L., CHARLETON *Onomastic. Zoic., Mantissa anatom.* Tab. I. p. 201; BLOCH *Ichth.* Tab. 87, GUÉRIN *Iconogr., Poiss.* Pl. 41, fig. 4; the *wide gab, sea-devil, angler; βάτραχος, Rana piscatrix* of the ancients. The widely gaping mouth is armed with numerous conical teeth. On the head are three moveable filaments, which are to be regarded as free rays of the first dorsal fin. That the fish moves these filaments to entice small fishes, is a statement already advanced by the ancients, and which a few years ago found a wordy defender in BAILLY *Mém. du Museum*, IX. 1824, pp. 117—131. But this fish would seem not only to take its prey with the fishing-rod but also with the net, and to this end makes use of the sac, which is formed behind the gill-cover by the elongation of the gill-membrane. GEOFFROY SAINT-HILAIRE *Ann. du Muséum* IX. pp. 417—420, X. pp. 480—481. At the fore part of the head on each side of the first

ray, lies the olfactory apparatus in form of a small stalked cup. (See a figure in SCARPA *De Auditu et Olfact.* Tab. IV. fig. 3.) This species occurs in the North Sea and in the Mediterranean Sea. Another species from Japan is *Lophius setigerus* VAHL, *Skrivter af. nat. Selskabet,* IV. 1, Tab. 3, figs. 5, 6, *Faun. Japon., Pisc.* Tab. 80.

Malthe (or *Malthœa*) CUV. Body scaleless, rough or muricate, anteriorly depressed, broad, posteriorly narrow, conical. Dorsal fin single, remote, with soft rays. (Branchiæ two and a half, with first branchial arch naked, and last branchiferous at the anterior surface alone.) Teeth crowded, small in both jaws.

a) Teeth in vomer and palate-bones none. Anterior part of body in front of pectoral fins circular, larger than trunk or caudal portion.

Halieutœa VALENC.

Sp. *Halieutœa stellata* VALENC., *Lophius stellatus* VAHL, l. l. figs. 3, 4, *Faun. Japon., Pisc.* Tab. 82; from the sea of China and Japan; when alive deep red; the body is beset with spines above, which proceed from the skin with three or four ray-like roots.

b) Teeth in vomer and palate-bones. Anterior part of body in front of pectoral fins cordate or trigonal, running out into a rostrum, with mouth inferior.

Malthe CUV., VALENC.

Sp. *Malthœa vespertilio* VALENC., *Lophius vespertilio* L. in part, BLOCH *Ichth.* Tab. 110, CUV. *R. Ani., éd. ill., Poiss.* Pl. 85, fig. 2; West Indies, and also some other species, all from the east coast of America, as *Malthœa angusta* CUV., *Malthœa cubifrons* RICHARDSON, *Faun. bor. Amer., Pisc.* Pl. 96, of which ROSENTHAL has figured the skeleton, *Ichthyot.* Taf. XIX. fig. 2, and others, distinguished by VALENCIENNES; CUVIER *et* VALENC. *Poiss.* XII. pp. 450—455.

Batrachus BL., SCHN. (Spec. of *Cottus* and *Gadus* L.). Head depressed, broader than trunk. Body naked in some, in some scaly. Teeth conical, in intermaxillary bone thin, small, crowded in a narrow belt, in lower jaw and in palate-bones and vomer larger, with apex rounded. Operculum small, spinose. Dorsal fins two, the first short, with three spinous rays, almost concealed in the skin, the second elongate, with soft rays. Ventral fins narrow, triradiate.

Toad-fish. These fishes hide in the sand and the muddy bottoms of bays. Species are found in the seas of both hemispheres. The pectoral fins are seated upon short arms, consisting of five (not as in *Lophius* only of two) carpal bones. The fourth branchial arch is without gills. Most of the

species are without scales; this is the case in the two species that were known to *Linnæus*. Sp. *Batrachus grunniens* BLOCH, *Cottus grunniens* L. (excl. synon. MARCGR.), BLOCH *Ichth.* Tab. 179, *Batrachoides gangene* BUCHANAN, *Gangetic Fishes*, Pl. 14, fig. 8; in the East Indies;—*Batrachus tau*, *Gadus tau* L. (not BL.), *Batrachoides vexillus* LESUEUR, *Mém. du Mus.* v. pp. 157, 158, Pl. 17, fig. 2; west coast of North America.

Other species have scales. Sp. *Batrachus surinamensis* BLOCH, SCHN. *Syst. Ichth.* Tab. 7, LAC. *Poiss.* II. Pl. 12, fig. 1;—*Batrachus conspicillum* CUV., *Gadus tau* BLOCH, *Ichth.* Tab. 67, fig. 2.[1]

Family XXIV. *Blennioidei* MUELL. Body elongate, compressed, with skin naked, mucous or covered with small scales (cycloid). Dorsal fin very long. Ventral fins separate, supported by only two or three rays, thoracic or jugular, sometimes none. Pyloric appendages none. Swimming-bladder none. Branchiostegous membrane mostly with six rays.

Anarrhichas L. Body compressed, with scales small, covered by mucous skin. Head anteriorly obtuso-rotundate. Mouth anteriorly with strong conical teeth in both jaws, and with rotundate tubercles dentiferous at the apex at the posterior part of both jaws, on vomer and palate-bones. Branchiostegous membrane with seven rays. Ventral fins none. Dorsal fin very long; caudal fin distinct, rounded.

Sp. *Anarrhichas lupus* L., BLOCH *Ichth.* Tab. 74, CUV. *R. Ani., éd. ill., Poiss.* Pl. 79, fig. 2; *Sea-wolf*, *Loup marin*, *Chat marin*, &c.; in the North Sea, not in the Medit. Sea; common in the North, especially at Iceland, where it is eaten dried and salted, whilst its skin is made into bags, and its gall used for soap. This fish is very predacious, and may attain a length of seven feet, quite an extraordinary size in this family. The brain is very small. In a specimen of 1.04 meters I found it not more than 0.02 long (from the origin of the olfactory nerves to the posterior margin of the cerebellum), and the greatest breadth (of the *corpora quadrigemina*) only 0.01. Compare on the osteology KUHL'S *Beiträge*.

Dictyosoma SCHLEG. Dorsal fin low, very long, produced from behind the head nearly as far as the apex of tail, supported by numerous pungent rays, in the posterior part by some only

[1] Here would seem to belong the species which NILSSON described as *Batrachus borealis*, but which does not appear to have been since observed. See KROEYER, *Danmark's Fiske*, pp. 473, 474. It occurs to us that this species may be *Batrachus barbatus* VALENC., *Batrachus didactylus* BL., SCHN., of which a specimen had strayed from the African to the Swedish coast.

that are soft and ramose. Ventral fins none. Branchiostegous membrane with six rays. Body covered with small scales, marked with transverse furrows.

Sp. *Dictyosoma Burgeri* nob., SCHLEGEL *Faun Jap., Pisc.* Tab. 73, fig. 3. This Japanese fish, which forms the transition between *Zoarces* and *Anarrhichas*, becomes 10″ long.

NOTE.—*Patœcus* RICHARDSON; is this its place? Comp. *Ann. of Nat. Hist.* XIV. 1844, p. 280.

Zoarces CUV. Body elongate, anguilliform, with scales small, not imbricate, resembling points dispersed through the skin. Dorsal fin long, depressed before the termination, supported at this part by undivided, inarticulate rays, elsewhere by soft rays, confluent with the long anal fin at the extremity of tail. Ventral fins jugular, triradiate. Teeth conical in both jaws, in a single row at the sides, the middle in two or three rows; palate edentulous. Papilla behind the vent in both sexes.

Sp. *Zoarces viviparus* CUV., *Blennius viviparus* L., BLOCH *Ichth.* Tab. 72, YARRELL *Brit. Fish.* I. p. 243; *Skandinav. Fiskar*, Pl. 8, fig. 1; the *eel-pout;* yellowish-brown, with black spots on the back, along the dorsal fin; this fish is only rarely 1′ long. That it is viviparous is already indicated by the name; the young continue for four months in the body of the mother, and are commonly born in December or January, although at other times also females have sometimes been found with fully developed young. Females have been observed with 300 young; usually however there are between 100 and 200. This species does not occur in the Mediterranean, but in the North Sea from 50 to about 70° N.L. Some American species also of this genus are known, of which one attains the remarkable length of 2′. *Zoarces labrosus, Blennius labrosus* MITCH., CUV. *et* VALENC. *Poiss.* XI. Pl. 341.

Gunnellus CUV., VAL. (*Murœnoïdes* LAC., *Centronotus* SCHN.) Body compressed, elongate. Teeth small, obtusely conical, in a single row in jaws, a few others behind this row in upper jaw; some very thin teeth in vomer. Head small, with mouth ascending obliquely. Dorsal fin long, with all the rays pungent, short. Ventral fins small, jugular, supported by one only or by two rays. Branchiostegous membrane with five or six rays. Scales small, dispersed, immersed in the skin.

Sp. *Gunnellus vulgaris* CUV., VAL., *Blennius gunnellus* L., BLOCH *Ichth.* Tab. 71, fig. 1, *Skandinav. Fisk.* Pl. 25, fig. 1, YARRELL *Br. Fish.* I. p. 239, become 8″ or at most 9″ long, five branchial rays; there is a row of deep

black spots (mostly ten) along the back and at the base of the dorsal fin partly bordered by a white edge. This species is oviparous, and occurs in the North Sea. It is more than probable that LINNÆUS confounded this fish with *Ophidion imberbe* (p. 124), when he admitted the last-named species into the Swedish Fauna.—In the *Fauna Japonica* two new species are described of this genus of *Blennoids*. For other species compare CUV. et VALENC. *Poiss.* XI. REINHARDT distinguishes here the following genus.

Stichæus REINH. Rays of branchiostegous membrane six. Several rows of pores or lateral lines.

Sp. *Gunnellus punctatus* VALENC., *Blennius punctatus* O. FABRICIUS, *Skrivter af Naturhistorie Selskabet*, II. 2, 1793, p. 84, Tab. 10, fig. 3. This species has indeed superficially some resemblance to *Gunnellus vulgaris*, yet the eye-shaped spots do not lie half on the back and half on the dorsal fin, but entirely on the last, and are less numerous; moreover the ventral fins are more developed and the head is larger, which is also the case with another species of this subdivision, *Stichæus unimaculatus* REINH.

Clinus CUV. Body compressed, scaly. Larger conical teeth in the front row of both jaws, lesser, crowded, arranged in a belt behind the former. Small teeth in vomer, sometimes also in palate-bones. Dorsal fin supported by many spinose rays, with a few posterior rays, soft, articulate. Ventral fins biradiate, jugular.

Sp. *Clinus argentatus* VAL., *Blennius argentatus* RISSO and *Bl. Audifredi* ejusd. *Ichth. de Nice*, Pl. 6. fig. 15, from the Medit. Sea;—*Clinus superciliosus*, *Blennius superciliosus* L., GRONOV., *Zoophyl.* Tab. V. fig. 5, BLOCH *Ichth.* Tab. 168; a feeler above the eye; the first three dorsal fin-rays produced; *rock-fish*, very common at the Cape of Good Hope, &c.

Add genera or sub-genera: *Cristiceps* CUV., VALENC., *Tripterygion* RISSO, VALENC., *Cirribarbis* CUV.

Myxodes CUV.

Sp. *Myxodes ocellatus* CUV., VAL. *Poiss.* XI. Pl. 335; from the sea of Chili, like the other Sp. of this genus.

Salarias CUV. Teeth numerous, setaceous, mobile, in a single row in each jaw; palatine teeth none. Ventral fins biradiate, jugular. Scales none. Dorsal fin mostly emarginate or divided into two lobes. Cirrus on each side above the eye.

Sp. *Salarias quadripennis* CUV., VAL., *Salarias ornatus* EHRENB., *Blennius gattorugine* FORSK. (not WILLUGHB.); Red Sea, Indian Ocean, &c. To this genus belongs also *Blennius fasciatus* BLOCH *Ichth.* Tab. 162, fig. 1.

Blennius CUV. Maxillary teeth elongate, thin, in a single row, with last tooth on both sides sometimes larger in lower or in both

jaws. Palatine teeth none. Scales none. Sometimes a fimbriate or pinnate cirrus over the eye on both sides. Ventral fins triradiate or biradiate, jugular.

Sp. *Blennius ocellaris* L., BLOCH *Ichth.* Tab. 167, fig. 1, CUV. *R. Ani., éd. ill., Poiss.* Pl. 77, fig. 1; YARRELL *Brit. Fish.* I. p. 223; the dorsal fin deeply incised; on the first and higher part is a black, round spot, surrounded by a white ring; in the Mediter. and occasionally in the North Sea, observed a few times on the English coast.

Pholis CUV.

Blennechis CUV., VALENC.

Chasmodes CUV., VALENC.

Family XXXV. *Gobiodei* MUELL. Anterior rays of dorsal fin inarticulate, all thin, flexile. Ventral fins jugular, supported by more than three rays, often broad and united together. (Swimming-bladder in some; in a few pyloric appendages, in most none.)

I. Ventral fins distinct, with first ray aculeate, the rest split. Four complete branchiæ.

Opisthognathus CUV. Eyes large. Superior maxillary bones large, protracted. Teeth thin, crowded into a belt in both jaws. Scales small. Branchiostegous membrane with six rays. (Swimming-bladder small.)

Sp. *Opisthognathus Sonneratii* CUV.;—*Opisth. Cuvierii* VALENC. *Poiss.* XI. Pl. 343.

Platyptera VAN HASS. (*Platypterus*). Body scaly. Head short, depressed. Mouth small, with very small teeth crowded in both jaws, in palate none. Branchial aperture large; branchiostegous membrane with six rays. Two distinct dorsal fins.

Sp. *Platyptera aspro* CUV., VALENC. *Poiss.* XII. Pl. 360; fresh-water fishes of Java (Bantam) and Celebes.

Callionymus L. (excl. *Callionymus indicus*). Head depressed, broader than body, with eyes approximate, looking upwards. Body naked. Jaws with thin crowded teeth; palate edentulous. Branchial aperture small, nuchal; branchiostegous membrane with six rays. Dorsal fins two, distant. Ventral fins jugular, broad.

Sp. *Callionymus Lyra* L. (male and *Callionymus Dracunculus* fem.), BLOCH *Ichth.* Tab. 161, fig. 2, CUV. *R. Ani., éd. ill., Poiss.* Pl. 82, fig. 1, *Skan-*

dinav. Fiskar, Pl. 22, 23; in the North Sea: this fish seldom is more than 10" long; there are four rays in the first dorsal fin, which in the male are very long; in the second dorsal fin, which in the female (*Call. Dracunculus*) is higher than the first, nine or ten are counted; there are neither pyloric appendages nor a swimming-bladder. In other species also of this genus the sexual difference is great; in *Callionymus ocellatus* PALL. *Spicil. Zool.* VIII. Tab. IV. figs. 1—3, the female, unless PALLAS be mistaken, would seem to have a higher first dorsal fin, with four ocelliform spots, which are absent in the male.

Hoplichthys CUV.

Sp. *Hoplichthys Langsdorfii* CUV. *et* VAL. *Poiss.* IV. Pl. 81, *Faun. Jap., Pisc.* Tab. 79, fig. 2. (The learned SCHLEGEL thinks that this genus has its place here, and not with the *Aspidoynathi*.)

Hemerocœtes CUV., VALENC.

Sp. *Callionymus acanthorhynchos* FORSTER, *Callionymus monopterygius* BL. *Syst. Ichth.*, from the Pacific, near New Zealand. Body scaly. Palate furnished with teeth. Dorsal fin single. Is this its place?

Trichonotus BL., SCHN. Body scaly, slender. Eyes superior, almost contiguous. Mouth with small acuminate teeth, crowded in jaws, vomer and palate-bones. Branchial aperture large; branchiostegous membrane with seven rays. Ventral fins jugular. Dorsal fin single, with first two rays very long.

Sp. *Trichonotus setiger* BL., *Syst. Ichth.* Tab. 39. Habitat?

Comephorus LAC. Body naked. Mouth large, with teeth very small, crowded in jaw, vomer and palate-bones. Branchial aperture large; branchiostegous membrane with six rays. Ventral fins none, pectoral long. Dorsal fins two.

Sp. *Comephorus baikalensis* LAC., *Callionymus Baicalensis* PALL., *Nov. Act. Petrop.* I. Pl. 9, figs. 2, 3.

Eleotris GRONOV. Body scaly, with trunk attenuated posteriorly, compressed. Head depressed, with eyes remote. Teeth small, crowded, arranged in both jaws in several rows. Branchiostegous membrane with six rays. Dorsal fins two, the first with flexile rays. (Swimming-bladder.)

Philypnus VAL. Small teeth in the anterior margin of vomer. (Maxillary teeth of front row larger, conical, distant.)

Sp. *Eleotris dormitatrix* CUV., *Platycephalus dormitator* BLOCH, *Syst. Ichth.*, Tab. XII. (the scales are not shewn), GUÉRIN *Iconogr., Poiss.* Pl. 40, fig. 1; a fresh-water species from S. America, which attains a size of 1 to 1½'.

BLEEKER refers to this sub-genus a species from Java, *Eleotris ophicephalus* K. and V. H.

Eleotris, VAL. Teeth in vomer none.

Sp. *Eleotris strigata* CUV., *Gobius strigatus* BROUSS. *Dec.*, Tab. 1;—*Eleotris mugiloides* CUV., VALENC., *Sciæna maculata* BLOCH, *Ichth.* Tab. 299, fig. 2, &c.

II. Ventral fins with first ray aculeate, the rest split, united together or joined to form a single infundibuliform fin.

Periophthalmus BL., SCHN. Teeth cylindric or conical in a single row in both jaws, palatine teeth none. Eyes contiguous, furnished at the inferior margin with a folded eye-lid. Pectoral fins placed upon a scaly peduncle. Dorsal fins two. Branchiostegous membrane with five rays.

Sp. *Periophthalmus Schlosseri* BL., SCHN., *Gobius Schlosseri* PALL., *Spicil. Zool.* Tab. I. figs. 1—4, CUV. *R. Ani., éd. ill., Poiss.* Pl. 81. fig. 1; Molucca Islands. In some species the teeth of the lower jaw are very fine, with the exception of the two middle teeth, which are placed somewhat backward. They form the genus *Boleophthalmus* of VALENCIENNES. To it belongs *Periophthalmus Boddærti, Gobius striatus* BL. *Syst. Ichth.* Tab. 14, &c.

Sicydium VALENC.

Comp. VALENC. in CUV. *et* VAL., *Poiss.* XII. p. 167. Sp. *Gobius Plumieri* BLOCH, *Ichth.* Tab. 178, fig. 3, LACEP. *Poiss.* Pl. 15, fig. 2;—*Gobius lagocephalus* PALL., *Spic. Zool.* VIII. Tab. 2, fig. 6, 7, &c.

Gobius L. (in part). Body covered with scales, sometimes very small; cheeks and opercles naked. Teeth crowded, numerous, small in both jaws, with an anterior row of teeth conical, larger; palatine teeth none. Branchiostegous membrane with five rays. Ventral fins united by the inner edge and by a transverse limb at the base, resembling a funnel.

a) *Dorsal fins two.*

Sp. *Gobius niger* L., YARRELL *Brit. Fishes*, I. p. 251, *Skandinav. Fiskar*, Pl. 36; in the North Sea;—*Gobius capito* CUV., GUÉR. *Iconogr., Poiss.* Pl. 39, fig. 1; in the Mediterranean Sea.—There are also fresh-water species of this genus; *Gobius fluviatilis* BONELLI, CUV. *R. Ani., éd. ill., Poiss.* Pl. 80, fig. 2; in Italy, and others in the East Indies.

b) *Dorsal fin single. Gobioïdes* LAC., VALENC.

Sp. *Gobioïdes Broussoneti* LAC., *Gobius oblongus* SCHN., CUV. *et* VAL. *Poiss.* XII. Pl. 348.

Apocryptes VALENC. Scales very small, immersed in mucous skin. Maxillary teeth in a single row. Dorsal fins two. Characters of *Gobius*.

Sp. *Gobius pectinirostris* L. &c.

Amblyopus VALENC., *Tænioides* LACEP. Body naked, elongate, anguilliform. Dorsal fin single. Mouth simous. Maxillary teeth in a single row, exsert, long. Eyes very small.

Sp. *Amblyopus cœculus* VALENC., *Gobius anguillaris* L.? *Amblyopus Hermannianus* VALENC., *Tænioides Hermanni* LAC. *Poiss.* II. Pl. 14, fig. 1; CUV. *et* VALENC. *Poiss.* XII. Pl. 350.

Trypauchen VALENC.

III. Ventral fins concrete into a disc, with all the rays undivided. (*Discoboli.*) Branchiæ three only or three and a half, with the last branchial arch naked on its posterior or on both sides. Swimming-bladder none.

Cyclopterus L. Body scaleless, covered with mucous skin, with some osseous points dispersed. Teeth small, acute, crowded in intermaxillary bone and lower jaw. Branchiostegous membrane with six rays. Pectoral fins large, produced under the throat. Rays of ventral fins conjoined by an orbicular membrane, disposed to form an oval disc. (Pyloric appendages numerous.)

J. MUELLER has separated this genus from the *Malacopterygii*, under which it was placed previously, and asserted its affinity with the *Gobioïds*. There are either two dorsal fins or a single longer one (*Liparis* ARTEDI); the rays of the first dorsal fin, or the anterior rays of the single dorsal fin, are simple bony rays, without joints.

The skeleton of these fishes is always soft and for the most part cartilaginous. It contracts much in drying, and then exhibits a laminated texture. The rays of the ventral fins are placed around an oval plate of bone: the whole forms a hollow sucker, which by its thick margin attaches itself by adhesion to the surface of solid bodies; if the attempt be made from without to detach the fish, it loosens the innermost part of the cavity, thus causing a vacuum, by which the attachment is rendered stronger. The loosing can be effected without considerable force by the volition alone of the fish, which moves the rays and thus raises the edge of the disc, so that the water can penetrate between it and the surface to which it adhered.—Comp. RATHKE *Bemerkungen über den Bau des Cyclopterus Lumpus*, MECKEL'S *Archiv f. d. Physiol.* VII. 1822. s. 498—524, with fig.

Sp. *Cyclopterus Lumpus* L., BLOCH *Ichth.* Tab. 30, LACEP. *Poiss.* II. Pl. 3, fig. 1, GUÉRIN *Iconogr., Poiss.* Pl. 62, fig. 2; the *lump-fish;* a figure of the skeleton is to be found in ROSENTHAL *Ichthyot. Taf.* XIX. fig. 1. Young

specimens of this fish are described under the name of *Cyclopterus minutus* PALL., *Spicil. Zool.* VII. Tab. 3, figs. 7—9, and *Gobius minutus, Zool. Danic.* See THOMPSON *Annals of nat. Hist.* III. 1839, pp. 38—43. This species has two dorsal fins, of which the first is almost entirely hidden in the thick skin. It occurs in the North Sea, as does another, *Cyclopterus Liparis* L., *Liparis barbatus* EKSTROEM, NOZEMAN *Uitgez. Verhandel.* I. bl. 581, Pl. IX. figs. 3, 4, BLOCH *Ichth.* Tab. 123, figs. 3, 4, with a single dorsal fin, which is very long, extends close to the caudal fin, and has thirty rays, of which the first thirteen are not jointed. On this species is founded the genus *Liparis* of ARTEDI, which has also been adopted by many modern writers.

Lepadogaster GOUAN. Pectoral fins large, descending below the throat, supported by four firmer rays at the lower part on each side; united around an oval disc in front of the concave disc of the ventral fins. Rays of branchiostegous membrane five or four. Dorsal fin single, remote, opposite to anal. Pyloric appendages none.

Lepadogaster Gouani LAC., *Lepadogaster rostratus* SCHN., GOUAN *Hist. Pisc.* Tab. I. figs. 6, 7, YARRELL *Brit. Fish.* II. p. 264; in the North Sea, &c.

Gobiesox LAC.

A genus scarcely distinct from the preceding, and imperfectly described by LACEPÈDE. Maxillary teeth conical, the anterior rather large. Ventral disc single, formed anteriorly by the united pectoral fins, posteriorly by the ventrals.

Sp. *Lepadogaster dentex, Cyclopterus dentex* PALL., *Spic. Zool.* Fasc. VII. Tab. I., CUV. *R. Ani., éd. ill., Poiss.* Pl. 108, fig. 1; the specimens in the *Rijks-Museum* are from the Cape of Good Hope.

Cotylis and *Sicyases* MUELL. and TROSCH. Branchiæ only three. Comp. MUELLER *Bau der Ganoiden*, p. 43, note, *Horæ Ichth.* III. 1849; pp. 17—20, Tab. 3.

IV. Ventral fins thoracic, narrow, contiguous at the base. Four perfect branchiæ. Head flat above, with an oval disc transversely costate. (*Naucratoidei.*)

Echeneis L. Teeth in jaws, vomer and palatine bones small, subulate, crowded, in palate towards the back part very small, passing gradually into a roughness scarcely to be distinguished. Lower jaw produced beyond upper. Eyes at the sides above the angle of mouth. Scales very small. Branchiostegous membrane with eight rays. (Body elongate, attenuate posteriorly; habitus almost of *Gadus.*)

Sucking-Fishes. Above the head and the anterior dorsal vertebræ there is a flat, oval disc or shield, presenting from the middle to both sides, obliquely placed, transverse plates, which may be compared with the slats of a sun-blind (*jalousie*); these parts are furnished in the middle, on the under-surface, with spine-like projections, which are connected by short bands with the skull and the anterior vertebræ. The upper margin of the plates is beset with fine teeth. By means of this disc these fishes can suck themselves fast to the shore, the sides of rocks, to other fishes, &c. Hence the story that they are able to stop a ship at full sail[1]. The organ, according to BLAINVILLE, is an anterior dorsal fin whose rays are split and expanded horizontally on each side, instead of standing up, *Journal de Physique, Août* 1822, pp. 132—134. The dorsal fin begins at the second half of the body opposite to the anal fin. These fishes have 6 or 8 pyloric appendages, but are without a swimming-bladder. AGASSIZ and MUELLER first removed this genus from the *Malacopterygii*, where it had previously been placed.

Sp. *Echeneis Remora* L., BLOCH *Ichth.* Tab. 172; fig. of the skeleton in ROSENTHAL *Ichthyot. Taf.* XX. fig. 1, and figs. 5—8 figures of the sucking disc, which in this species has 17 or 18 plates (LINNÆUS names them *striæ*). In the Mediterranean Sea; it has also been found a few times in the Atlantic Ocean. The *Rijks-Museum* contains a specimen from the Cape of Good Hope; and this species has been also seen a few times on the English coast; YARRELL *Brit. Fish.* II. p. 280.

But more widely dispersed is *Echeneis naucrates* L., BLOCH *Ichth.* Tab. 171, which occurs in the Atlantic Ocean, on the coasts of America and Africa, in the Red Sea and the Indian Ocean, nay even in Japan, with 23 or 24 (rarely 22) plates on the sucking disc. There are still some other species of this genus. The smallest number of plates observed on the sucking disc is in *Echeneis lineata* BLOCH, SCHN. *Syst. Ichth.* Tab. 53, fig. 1, which, with a body much elongated and a longitudinal head-shield, has only 10.

Family XXXVI. *Notacanthini* (MUELL.) Body elongate, compressed, covered with small scales. Free spines numerous, taking the place of dorsal fin, or placed in front of dorsal fin. Ventral fins abdominal or none. Pseudobranchiæ none.

MUELLER has separated this small group of fishes from the large family of the *Scomberoids*, to which they were referred by CUVIER; he leaves it doubtful whether *Tetragonurus* belongs to it, which genus we leave in the neighbourhood of *Mugil* until further investigation has thrown light on the question.

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[1] The ancients ascribe to these fishes still more strange properties; such stories are recorded in PLINIUS with singular credulity. *Hist. nat.* Lib. IX. cap. 25, and especially Lib. XXXII. C. 1.

Notacanthus BL., *Kampylodon* O. FABR., *Acanthonotus* BL., SCHN. Body elongate, compressed. Teeth thin, numerous in upper jaw in a single row, in lower in several rows in the middle, in a single row at the sides. Palatine teeth thin, in several rows. Branchiostegous membrane with eight rays. Ventral fins abdominal. Several spines, short, separate, in the place of dorsal fin. Anal fin long, extending as far as the small obtuse caudal fin. (Scales small. Upper jaw protracted beyond lower, obtuse.)

Sp. *Notacanthus Fabricii, Campylodon Fabricii* REINH., O. FABRICIUS in *Skrivter af Naturhistorie Selskabet*, IV. 2, 1798, pp. 22—26, Tab. 9, fig. 1, CUV. *R. Ani., éd. ill., Poiss.* Pl. 55. fig. 2; a rare fish from Greenland. CUVIER holds this fish for the same species as *Notacanthus nasus* BLOCH, *Ichth.* Tab. 431, *Syst. Ichth.* Tab. 77, CUV. *et* VAL. *Poiss.* VIII. Pl. 241, which would seem to be from the East Indies; there is however no certainty as to this last habitat; but the two fishes present some difference, especially in the ventral fins, which in the specimen of FABRICIUS had three spinous rays in front of the eight jointed rays, in that of BLOCH only one; compare REINHARDT in *Kongel. Danske Videnskab. Selskabs naturvidenskab. og mathem. Afhandlinger*, VII. 1838, p. 120. There were until lately only two specimens of this genus preserved in cabinets; the specimen of FABRICIUS at Copenhagen, that of BLOCH at Berlin; not long ago the Parisian Museum obtained one through GAIMARD from the voyage of discovery to the North, which is figured in the illustrated edition of CUVIER'S *R. Ani.*

Mastacembelus GRONOV. (*Rhynchobdella* BL., SCHN.). Head rostrate, acute. Mouth with very small teeth, crowded in several rows. Branchiostegous membrane with six rays. Ventral fins none. In place of first dorsal fin several loose spines; second dorsal fin opposite to anal, low, produced as far as caudal fin, or confluent with anal and caudal. Three spines in front of anal fin.

Mastacembelus haleppensis CUV., AL. RUSSEL *Hist. of Aleppo*, &c. Lond. 1756, 4to, Tab. v. figs. 1, 2, GRONOVIUS *Zoophyl.* I. Tab. VIII. *a*, figs. 1, 2, HECKEL *Fische Syriens* 1843, Tab. 19, fig. 3; fresh-water fish of Asia Minor. The other species, also from Asia, are seldom more than 10 or 11″ long, *ex. gr. Mastacembelus ocellatus, Rhynchobdella orientalis* and *aral* BLOCH, SCHN. Tab. 89, &c. A species however from Borneo appears to attain a greater size than the rest, of which the *Rijks-Museum* has a couple of specimens under the name of *Mastacembelus pictus;* it seems to be the same as that lately described by BLEEKER under the name of *Mastacembelus erythrotœnia.* (*Verh. van het Batav. Gen.* XXIII. Dl. 1850.)

The distinction of *Rhynchobdella* (*Macrognathus* LAC.) and *Mastacembelus* as two genera is not essential. In *Rhynchobdella aral* BLEEKER found in a large specimen the caudal fin confluent with the anal and dorsal fins, which in younger specimens are distinct from each other. Also the greater protraction of the upper snout (the jaws are never of the same size) is no very essential character. These fishes have a swimming-bladder.

Family XXXVII. *Tænoidei.* Body compressed, elongate, ensiform, with scales very small or none. Eyes large. Dorsal fin very long. Ventral fins thoracic, or none. Teeth small or none. (Branchiostegous membrane with rays mostly six. Swimming-bladder in some.)

A. Mouth protractile, aperture small.

Stylephorus SHAW. Mouth edentulous. Body scaleless. Ventral fins none. Caudal fin erect upwards, with last ray continuous with body and produced into a seta longer than body. Branchiostegous membrane with four rays.

Of this genus one specimen alone is known, which was taken in the Mexican Sea, *Stylephorus cordatus* SHAW, LINN. *Trans.* I. p. 90, Tab. VI. (an unnatural figure, copied in BLOCH *Syst. Ichth.* Tab. 99); BLAINVILLE has given a more accurate figure and description of that specimen, *Journal de Physique*, Tom. 87, 1818, pp. 68—71, Pl. I. fig. 1. Compare the description in CUV. *et* VAL. *Poiss.* X. pp. 382—386, according to the investigations of VALENCIENNES.

Trachypterus GOUAN, *Gymnogaster* BRUENNICH, *Bogmarus* BL., SCHN. Mouth protractile, narrow, longitudinal, fornicate above, with teeth few, conical, small, distant in both jaws. Body scaleless. Lateral line armed with small osseous scutes furnished with a short spine directed forward. Ventral fins thoracic, with several rays, often elongate. Dorsal fin extended through the whole length of body, high at the anterior part, with rays produced. Caudal fin erect. Rudiment of anal fin at the apex of tail. Branchiostegous membrane with six (or seven?) rays.

Sp. *Trachypterus bogmarus* VALENC., *Gymnogaster arcticus* BRUENNICH; this fish from the North Sea at Iceland, sometimes also captured on the Norwegian and Scottish coasts, was figured accurately for the first time by REINHARDT *Kongel. Danske Videnskabernes Selskabs naturvidensk. og mathem. Afhandlinger*, VII. 1838, pp. 65—82, Tab. I. II., which figure reduced is copied by YARRELL *Brit. Fish. Suppl.* 1839, p. 14. This fish, named *Vaagmær* (pronounced *Vogmer*), is from three to near eight feet long. The body continues of the same height for more than one half the length, whilst in some species from the Medit. Sea it becomes suddenly lower towards the tail. Such is *Trachypterus iris* CUV., CUV. *et* VAL. *Poiss.* X. Pl. 297. In this respect, on the other hand, a specimen from the Cape of Good Hope, which the *Rijks-Museum* received through Dr HORSTOK, agrees with the northern *Vaagmaer*, or is perhaps not specifically distinct from it.

There are in these fishes numerous pyloric appendages; the swimming-bladder is absent. The skin is covered with a silvery envelope, corresponding

to the silvery covering of the choroid of the eye in fishes, and consists of microscopic needle-shaped crystals. Comp. on these and some other anatomical peculiarities of the *Vaagmaer*, REID in *Annals of nat. Hist.*, Sec. Series, III. 1849, pp. 456—477.

Gymnetrus BLOCH, VALENC.

NOTE.—CUVIER (*R. Ani.* II. p. 219) joined the preceding genus with *Gymnetrus* under this common name; VALENCIENNES again separated the genera. *Gymnetrus* differs from *Trachypterus*, an allied genus, in the ventral fins being with one ray, which is very long and increased towards the extremity by membrane. Body without scales, with hard osseous points scattered; lateral line unarmed. Teeth none. Caudal fin none or small, confluent with dorsal.

Sp. *Gymnetrus remipes* BL., SCHN., *Regalecus glesne* ASCAN., BLOCH *Syst. Ichth.* Tab. 88, *Encycl. méth. Poiss.* Pl. 86, fig. 258; North Sea, on the Norwegian coast; becomes ten or twelve feet long.—*Gymnetrus Banksii* VALENC.; comp. HANCOCK and EMBLETON, *Account of a Ribbon Fish (Gymnetrus) taken off the coast of Northumberland, Ann. of nat. Hist., Sec. Series*, IV. 1839, pp. 1—18, Pl. I. II.; this specimen was 12′ 3″ long. In the Medit. Sea also one or two species of this genus occur, of 6—8 feet in length, *Gymnetrus Gladius* VALENC. (*Gymnetrus longiradiatus* RISSO), CUV. *et* VAL. *Poiss.* X. Pl. 298, and *Gymnetrus telum* VAL. *ibid.* Pl. 299.

B. Mouth scarcely or not at all protractile, with aperture large, oblique, the lower jaw ascending.

Lophotes GIORNA. Body scaleless. Teeth small, scattered in several rows in jaws; small teeth in palate-bones and vomer. Head with a vertical crest sustaining an elongate strong spine, the first ray of dorsal fin. Dorsal fin extended through the whole length of body, with numerous simple rays; anal fin small, placed towards the end of tail; caudal fin small, distinct. Ventral fins very small, distant, adjacent to pectoral fins.

Sp. *Lophotes cepedianus* GIORNA, *Mém. de l'Acad. de Turin*, 1805—1808, pp. 12—19, Pl. 2 (cited by CUVIER), CUV. *Ann. du Mus.* XX. 1813, pp. 393—400, Pl. 17; CUV. *et* VAL. *Poiss.* X. Pl. 301; in the Medit. Sea; this species becomes more than 4′ long; it has been observed only seldom. A Japanese species, also very rare, is figured in the *Fauna Japonica, Pisces*, Tab. 71, fig. 2.

Cepola, L. Body covered with small scales. Teeth in jaws in a single row, distant, subulate, thin, the middle in lower jaw larger, in palate and vomer none. Dorsal and anal fins very long,

extending as far as the apex of tail. Caudal fin very narrow, with middle rays longer. Ventral fins moderate, approximate.

Sp. *Cepola rubescens* L., BLOCH *Ichth.* Tab. 170 (named *Cepolæ tæniæ* L., a species to be suppressed), YARRELL *Brit. Fish.* I. p. 195, *Dict. univ. d'Hist. nat., Poiss.* Pl. 10, fig. 2; in the Medit. Sea;—*Cepola Krusensterni* SCHL., (*Cepola limbata* and *Cepola marginata* VAL.?) *Faun. Jap. Pisc.* Tab. 71, fig. 1; from Japan; in this species the scales are more conspicuous, the head also under the eyes and the gill-covers are covered with scales. In this genus a large swimming-bladder is present, and some moderately large appendages (in *Cepola rubescens* eight) surround the pylorus.

Family XXXVIII. *Scomberoidei.* Body smooth, covered with very small scales, mostly compressed. Lateral line in the last part often marked with larger carinate scales, or with a membranous crest. Tail and mostly caudal fin signally developed. Eyes large. Scales sometimes at the base of dorsal and anal fins; the remaining part of the membrane connecting the rays feeble, soft, in some entirely absent, the fins being resolved posteriorly into spurious finlets. Ventral fins thoracic or none. Opercular bones with margin smooth. (Pyloric appendages numerous. Swimming-bladder present in some, in others wanting.)

I. *Mouth not protractile into a tube.*

A. *Lateral line not carinate.*

Lepidopus GOUAN. Body compressed, elongate, scaleless. Gape of mouth ample, with lower jaw prominent. Maxillary teeth acute, compressed, disposed in a single row, a few larger in the middle on each side behind the continuous set. Branchiostegous membrane with eight rays. Two rigid scales in place of ventral fins. Dorsal fin continuous, very long. Anal fin small. Caudal fin distinct.

Sp. *Lepidopus argyreus* CUV., CUV. *et* VAL. *Poiss.* VIII. Pl. 223, *R. Ani., éd. ill., Poiss.* Pl. 671, *Trichiurus gladius* HOLTEN, *Skrivter af naturh. Selskabet*, v. 2, 1802, pp. 19—28, Tab. 2, fig. 1; in the Med. Sea and the Atl. Ocean. Is the *Lepidopus Gouani* BL., SCHN., GOUAN *Hist. Pisc.* Tab. I. fig. 4, BL. *Ichth.* Tab. 53, fig. 2, the same species with the caudal fin mutilated?

Trichiurus L. Branchiostegous membrane with seven rays. Ventral fins none. Numerous short spines in place of anal fin. Tail subulate, finless. (Remaining characters almost those of the preceding genus.)

Sp. *Trichiurus lepturus* L.; BLOCH *Ichth.* Tab. 158, from the S. American coasts;—*Trichiurus savala* CUV. *R. Ani., éd. ill., Poiss.* Pl. 68, Indian Sea, &c.

Xiphias L. (with addit. of some new species). Body elongate, somewhat round and tapering, covered with very small scales. Snout narrow, produced, with upper jaw longer, ensiform. Jaws with teeth small, acute, crowded, sometimes scarcely distinct, or only forming a rough surface. Rays of branchiostegous membrane seven. Dorsal fin very long. Caudal fin broad, divided deeply into two lobes. Tail with a middle carina or with two cutaneous folds on each side at the base of caudal fin.

* *Middle crest on each side at the base of caudal fin.*

Xiphias L. Ventral fins none.

Sp. *Xiphias gladius* L., BLOCH *Ichth.* Tab. 79, CUV. *R. Ani., éd. ill., Poiss.* Pl. 50; the skeleton in ROSENTHAL *Ichthyot. Taf.* 21; the *sword-fish;* Medit. Sea, Atl. Ocean, rarer in the North Sea, sometimes also in the Baltic; this fish attains a length of 12, sometimes even of 18'. In old specimens the dorsal fin is divided in the middle, so that there appear to be two dorsal fins. In younger individuals the jaws are less unequal. The long upper snout is formed by the vomer and the intermaxillary bones.

On the pyloric appendages of this fish see above, p. 27. The little gill-plates are here connected in a retiform manner, so that each gill consists of two laminæ. See the figures in F. ROSENTHAL, *Abhandlungen*, 1824, Tab. 6.

** *With two crests on each side at the base of caudal fin. Snout slender.*

Machœra CUV. (*Makaira* LAC.). Ventral fins none.

Comp. CUVIER *Nouv. Annales du Mus.* I. 1832, pp. 43—49, Pl. 3, *Machœra velifera*, from W. Indies.—This sub-genus appears to me doubtful unless it be established that the ventral fins are also wanting in younger specimens; it is certainly more nearly allied to *Histiophorus* than to *Xiphias.*

Histiophorus LAC. (*Notistium* HERM.). Ventral fins thoracic, long, with two or three rays. Dorsal fin very high. Maxillary teeth crowded, small, unequal.

Histiophorus americanus CUV. *Xiphias velifer* BL., *Guebucu* MARCGR. *Hist. nat. Bras.*, p. 171;—*Histiophorus indicus* CUV. *Hist. des Poiss.* VIII. Pl. 229;—*Histiophorus orientalis* SCHLEG. *Faun. Japon., Pisc.* Tab. 55;—*Histiophorus immaculatus* RUEPPELL, *Transact. of the Zool. Soc.* II. Part I. 1836, Pl. 16, &c.

Tetrapterus RAFIN. Dorsal fin higher at the commencement, elsewhere low. (Other characters almost those of *Histiophorus.*)

Sp. *Tetrapterus belone* RAFIN., CUV. *et* VAL. *Hist. des Poiss.* VIII. Pl. 227, 228; Medit. Sea.

Coryphæna L. (exclusive of some species). Body compressed, elongate. Teeth subulate, crowded in the middle part of both jaws, with an anterior continuous row of somewhat larger. Branchiostegous membrane with seven rays. Head compressed, high, truncato-declivous. Dorsal fin long, continuous. Ventral fins thoracic.

a) *Teeth crowded, small in vomer and palate-bones. Dorsal fin of the length of back, beginning above the eyes. Eyes approximate to the margin of mouth.*

Sub-genus *Coryphæna* CUV., (add *Lampugus* CUV., VAL., *Caranxomorus* LAC.).

Sp. *Coryphæna hippurus* L., RONDELET *De Piscib.* p. 255, CUV. *et* VAL. *Poiss.* IX. Pl. 266, BONAP. *Faun. Ital., Pisc.* Tab. 126, fig. 1; in the Medit. Sea. The dorsal fin is high forwards. The high bony ridge on the top of the skull is remarkable, which extends to the upper jaw; the superior spinous processes also of the five anterior vertebræ are strongly developed, and compressed laterally. This fish becomes fully two, sometimes nearly four feet long.—*Coryphæna pelagica, Scomber pelagicus* L., BONAP. l. l. fig. 2, with lower dorsal fin and shorter body; also in the Med. Sea; some exotic species also, principally from the Atl. Ocean on the east coast of South America, as that which is figured by PLUMIER, and copied by BLOCH as *Coryphæna hippurus, Ichth.* Tab. 174.

b) *Teeth in vomer and in palate-bones none. Dorsal fin beginning behind the head.*

Centrolophus LACEP. (*Pompilus* RONDEL., WILLUGHB.)

Sp. *Coryphæna pompilus* L., CUV. *R. Ani., éd. ill., Poiss.* Pl. 65, BONAP. *Faun. Ital., Pisces,* Tab. 127, fig. 2; in the Medit. Sea and the Atlantic Ocean; this fish attains a size of fully 2′. With respect to the exact species which LINNÆUS described some uncertainty prevails, but the fish here recorded is certainly the *Pompilus* of RONDELET.

Schedophilus COCCO, BONAP.

Is this its place? Præoperculum denticulate, operculum furnished with a spine produced over the pectoral fins. Some short free spines in front of dorsal fin. Sp. *Schedophilus medusophagus* COCCO, from the Mediter. Sea; see BONAP. *Faun. Ital.* Tab. 127, fig. 3.

Astrodermus BONELLI. Body compressed, covered with small scales, discoidal, pedunculate, radiant at the margin. Dorsal fin of the length of back, high. Ventral fins approximate, jugular.

Maxillary and palatine teeth small, thin; maxillary in a single row. (Rays of branchiostegous membrane four or five.)

Sp. *Astrodermus coryphænoides* BONELLI, *Coryphæna elegans* RISSO, CUV. *et* VALENC. *Poiss.* IX. Pl. 270, BONAP. *Faun. Ital.* Tab. 170, fig. 1; Mediter. Sea, very rare.

Pteraclis GRONOV., *Oligopodus* LACEP. Body compressed, covered with large broad scales emarginate posteriorly. Teeth thin in jaws, vomer and palate-bones. Branchiostegous membrane with seven rays. Dorsal and anal fins long, high; dorsal of the length of back. Ventral fins jugular, approximate.

Sp. *Pteraclis velifera* BL., SCHN., *Pteraclis guttatus* VALENC., *Coryphæna velifera* PALLAS, *Spic. Zool.* VIII. Tab. 3, fig. 1, GRONOV. *Act. Helvet.* VII. Basiliæ, 1772, p. 43, Tab. 2; from the Indian Sea? QUOY and GAIMARD brought a fish of the kind from the Strait of Mosambique, *Pteraclis ocellatus* VALENC., CUV. *et* VAL. *Poiss.* IX. Pl. 271; BOSC brought a small specimen from the Atlantic Ocean at Carolina, *Pteraclis Carolinus*. The species of this genus, of which a few specimens only are found in cabinets, are however far from being sufficiently defined.

Kurtus BLOCH. Body compressed, high, with back carinate. Scales very small, scarcely distinguishable. Teeth very minute in jaws and palate. Branchiostegous membrane with seven rays. Dorsal fin moderate, in the middle of back; anal fin long. Ventral fins jugular.

Sp. *Kurtus indicus* BLOCH, *Kurtus Blochii* LAC., BLOCH *Ichth.* Tab. 169, CUV. *et* VALENC. *Poiss.* IX. Pl. 277; from the Indian Sea, at Java, &c.

Stromateus L. Body compressed, ovate. Teeth very minute, in a single row in jaws, in palate none. Branchiostegous membrane with six rays (more rarely seven). Dorsal fin opposite to anal, longitudinal, with short, concealed anterior spines: both scaly. Ventral fins none or small, jugular. Caudal fin large, bifid.

a) *With ventral fins small.*

Seserinus CUV.

Sp. *Stromateus microchirus, Seserinus microchirus* CUV., RONDEL. *De Piscib.* p. 287, BONAP. *Faun. Ital.* Tab. 125, fig. 2; Mediterranean Sea.

b) *With ventral fins none (or obsolete in adults).*

Sub-genera: *Stromateus* CUV., *Rhombus* LAC., CUV. *et* VAL. (previously *Peprilus* CUV.).

Sp. *Stromateus fiatola* L.; BELON *de Aquatilib.* p. 153, BONAP. l. l. fig, 1; in the Mediterranean Sea;—*Stromateus niger* BLOCH, *Ichth.* Tab. 160 (and 422),

Indian Sea at Java, &c. (According to a communication of Dr P. BLEEKER, ventral fins are present in young individuals of this species, and it is upon such that the genus *Apolectus* CUV. *et* VAL. *Poiss.* VIII. Pl. 338, is founded.)

Luvarus RAFIN., *Proctostegus* NARDO.

Sp. *Luvarus imperialis* RAFIN.; from the Mediterranean Sea.

Note.—This fish is unknown to me: is this its place? Teeth none. Branchiostegous membrane with 3 or 4 rays. Body scaleless. Anus covered by an osseous scale. Ventral fins none. Authors say that it is allied to the genus of the *Stromatei*. Comp. RAFINESQUE, SCHMALZ *Caratteri di alcuni nuovi generi*, &c. Palermo, 1810, 8vo, p. 22; and J. D. NARDO *De Proctostego novo Piscium genere Specimen*, Patavii, 1827, 4to.

Seriola CUV., *Micropteryx* AGASS. Body compressed, covered with small scales. Teeth minute, thin, crowded in jaws, vomer and palate-bones. Branchiostegous membrane with seven rays. Ventral fins thoracic. Dorsal fins two, the anterior aculeate, shorter. Aculeus incumbent in front of the anterior dorsal fin; two aculei in front of anal fin.

Sp. *Seriola cosmopolita* CUV., *Scomber chloris* BL. *Ichth.* Tab. 339, SPIX *Pisc. Brasiliens.* Tab. 59, CUV. *et* VAL. *Poiss.* IX. Pl. 259; in the Atlantic, on the coasts both of America and Africa, and in the Indian Ocean.

Temnodon CUV. (Characters almost of the preceding genus, but jaws with front row of teeth acute, flat, distant.)

Sp. *Temnodon saltator* CUV., *Gasterosteus saltatrix* L., *Pomatomus Skib* LAC., *Poiss.* IV. Pl. 8, fig. 3, (also under the name of *Cheilodipterus heptacanthus*, figured in the same work, III. Pl. 21, fig. 3, according to COMMERSON) CUV. *R. Ani., éd. ill., Poiss.* Pl. 56, fig. 3; this species lives in almost the whole ocean, and also in the eastern parts of the Mediterranean Sea.

Lactarius CUV., VALENC.

Sp. *Lactarius delicatulus* VALENC., *Scomber lactarius* BL., SCHN.

Nomeus CUV. Body elongate, covered with very small scales. Teeth subincurved, distant, in a single row in jaws, in vomer and palate-bones. Branchiostegous membrane with seven rays. Ventral fins thoracic, large, broad, concrete at the inner margin. Dorsal fins two.

Sp. *Nomeus Mauritii* CUV., *Gobius Gronovii* GM., *Eleotris Mauritii* BLOCH, SCHN., *Gobiomorus Gronovii* LAC., MARCGR. *Hist. Nat. Brasil.* p. 153[1]; —*Nomeus Peronii* CUV., GUÉRIN *Iconogr., Poiss.* Pl. 31, fig. 1.

[1] MARCGRAF does not, as is stated by LACEPÈDE and others, name this fish *Harder*, but only says, *piscis figura similis illi, quem vulgo Harder appellamus.*

Porthmeus Cuv., Valenc.

Nauclerus Cuv., Valenc.

Psenes Cuv., Valenc. Body oval, compressed. Head obtuse anteriorly, declivous, short. Jaws with thin teeth, in a single row; palatine teeth none. Branchiostegous membrane with six rays. Dorsal fins two, contiguous. Ventral fins thoracic. Scales moderate.

Sp. *Psenes cyanophrys* Cuv., Val. *Poiss.* ix. Pl. 265. &c.

Trachinotus Lac. (*Trachinotus* and *Lichia* Cuv.). Body compressed, oblong or oval. Teeth thin, crowded in jaws and palate. Branchiostegous membrane with 7—9 rays. An incumbent spine, directed forwards in the anterior part of back, over pectoral fins; several other short free spines, in place of first dorsal fin; second dorsal fin soft, opposite to anal. Two spines in front of anal fin. Ventral fins short, thoracic. Caudal fin large, deeply bifid, with elongate, produced lobes.

Sp. *Trachinotus glaucus* Cuv., *Chætodon glaucus* Bloch, *Ichth.* Tab. 210, South America, West Indian Sea;—*Trachinotus amia, Scomber amia* L., *Lichia amia* Cuv., Rondel. *De Piscib.* p. 254, Cuv. *R. Ani., éd. ill., Poiss.* Pl. 54, fig. 3; this species becomes more than 4′ long; it occurs in the Mediterranean Sea and in the Atlantic Ocean as far as the Cape of Good Hope, as does *Scomber glaucus* L. (*Lichia* Cuv.), Cuv. *et* Valenc. *Poiss.* viii. Pl. 234.

Chorinemus Cuv., Valenc. (*Scomberoides* Lac.).

(Characters and habit nearly of *Trachinotus*, but there are several false dorsal and anal finlets. Scales small, lanceolate).

Naucrates Rafin. Body elongate, fusiform. Head compressed. Teeth thin, crowded in jaws and palate. Branchiostegous membrane with seven rays. Some free spines in place of first dorsal fin. Two spines in front of anal fin.

Sp. *Naucrates ductor* Cuv., *Gasterosteus ductor* L., *Scomber ductor* Hasselq., Bloch *Ichth.* Tab. 388, Cuv. *et* Val. *Poiss.* viii. Pl. 232, Yarrell *Brit. Fish.* i. p. 149; bluish, with broad perpendicular darker bands. This fish lives in the Mediterranean Sea and in many parts of the Atlantic Ocean; and since it follows ships, like sharks, in order to catch what falls overboard, is well known to sailors by the name of the *pilot-fish, loots-mannetje, lootse, le pilote*, &c.—*Naucrates indicus* Cuv., Guérin *Iconogr., Poiss.* Pl. 30, fig. 1, &c.

Elacate Cuv. (Characters of the preceding genus, but no spines in front of anal fin. Head elongate, depressed.)

Sp. *Elacate atlantica* Cuv., *Scomber niger* Bloch, *Ichth.* Tab. 337, Cuv. et Valenc., *Poiss.* viii. Pl. 233, &c.

Lucoscombrus mihi (*Gempylus* and *Thyrsites* Cuv.). Body elongate, compressed, with scales none or conspicuous only at the end of tail and along the lateral line. Teeth compressed, acute, unequal, in a single row in jaws, the middle of upper jaw much larger than the rest. Branchiostegous membrane with seven rays. Head elongate, depressed above; lower jaw produced beyond upper. Ventral fins thoracic. Dorsal fins two contiguous, and several free finlets behind the second.

Gempylus Cuv. Vomer and palate-bones edentulous. Ventral fins very small.

Sp. *Lucoscombrus serpens, Scomber serpens* Solander;—*Lucoscombrus coluber, Gempylus coluber* Cuv. et Val. *Poiss.* viii. Pl. 221, &c.

Gempylus approaches *Lepidopus* by its much elongated body.

Thyrsites Cuv. Teeth in vomer and palate-bones few, in a single row, conical. Ventral fins small or moderate.

Sp. *Lucoscombrus atun, Scomber atun* Lac., *Thyrsites atun* Cuv., Cuv. et Val. *Poiss.* viii. Pl. 219, Cuv. *R. Ani., éd. ill., Poiss.* Pl. 49, fig. 1; a fish from the sea around South Africa, very common at the Cape of Good Hope, and known to the Dutch colonists as a palatable and very cheap food under the name of *Snoek* (Pike). This species attains a length of more than 3′.

Ruvettus Cocco, *Rovetus* Cantraine. Body elongate, compressed. Teeth conical, compressed, in a single row in both jaws; teeth few, incurved in vomer and palate-bones. Branchiostegous membrane with seven rays. Small biaculeate horny shields dispersed in regular rows throughout the body; scales very small. First dorsal fin long, depressed, second higher, almost contiguous to the former. A single false finlet behind the second dorsal fin, opposite to a similar accessory anal fin.

Sp. *Ruvettus pretiosus* Cocco, *Rovetus Temminckii* Cantraine, Bonap. *Faun. Ital., Pisces,* Tab. 128, *Mémoir. de l'Acad. de Bruxelles,* Tom. x. 1835. This fish attains a length of from 4′ to 5′, and is found in the Mediterranean Sea at Sicily and Malta.

Cybium Cuv. Body compressed, oval. Teeth in jaws in a single row, triangular, often large; teeth in palate small. Branchi-

ostegous membrane with seven rays. Tail carinate in the middle, and with two oblique cutaneous folds on each side at the base of caudal fin. Dorsal fins two, contiguous; posterior part of second resolved into spurious fins, opposite to anal finlets. Ventral fins thoracic, short.

Sp. *Cybium Commersonii* Cuv., *Scomber Commersonii* Lacep., &c. Species from the Indian and West Indian Seas.

Pelamys Cuv. (*Sarda* previously). Larger scales in a belt around the pectoral fins.

Sp. *Cybium Pelamys*, *Scomber Pelamys* Bruennich (not L.), *Scomber Sarda* Bloch, *Ichth.* Tab. 334, Cuv. *et* Valenc. *Poiss.* viii. Pl. 217; in the Mediterranean Sea and also in the Atlantic Ocean, along the east coast of America.

Thynnus Cuv. (with addit. of subgenus *Orcynus* Cuv. *R. Ani.*). Body compressed, oval, with tail slender. Teeth small, subulate, in a single row in jaws; fine crowded teeth in vomer and palate-bones. Branchiostegous membrane with seven rays. Tail carinate in the middle, and with two oblique cutaneous folds at the base of caudal fin on each side. Dorsal fins two, subcontiguous; posterior part of second resolved into several spurious pinnules, opposite to the anal finlets. Scales larger, and somewhat coarser round the pectoral fins, in the anterior part of back and at the lateral line.

Sp. *Thynnus vulgaris* Cuv., *Scomber Thynnus* L., Cuv. *et* Val. *Poiss.* viii. Pl. 210, Guérin *Iconogr.*, *Poiss.* Pl. 27, fig. 2; the *tunny;* this fish becomes more than 8′ long, lives principally in the Mediterranean Sea, but is, however, also captured in the Atlantic Ocean and North Sea. The pectoral fin is long, scythe-shaped; still longer is it in *Thynnus alalonga*, *Scomber alalunga* Gmel., Cuv. *et* Val. *Poiss.* viii. Pl. 215, where it extends as far as behind the connected part of the second dorsal fin, and attains almost one-third of the length of the whole body. In the seas of warm regions is found *Thynnus Pelamys* Cuv., *Scomber Pelamys* L., Cuv. *et* Valenc. *Poiss.* viii. Pl. 213, *Faun. Jap., Pisc.* Tab. 49, with short pectoral fins and four brown longitudinal bands on each side of the belly (*la bonite à ventre rayé*).

Scomber Cuv. (Species of gen. *Scomber* L.). Teeth (and almost all the other characters) of the preceding genus. Dorsal fins two, remote from each other, with a large part of the middle of back finless.

Auxis Cuv. Scales larger at the anterior part of back and around the pectoral fin. Tail carinate in the middle.

Sp. *Auxis vulgaris*, Cuv., *Scomber bisus* Rafin., *Scomber Rochei* Risso, Rafinesque *Caratteri*, &c. Tab. II. fig. 1, Cuv. *et* Valenc. *Poiss.* VIII. Pl. 216, in the Mediterranean Sea;—*Auxis taso* Cuv., *Scomber taso* Commerson, New Guinea.

Scomber Cuv. Scales of whole body small, almost equal. Tail with two cutaneous folds on each side at the base of caudal fin, without a middle keel.

Sp. *Scomber scomber* L., Bloch *Ichth.* Tab. 54; *Skandinaviens Fiskar*, Pl. 29; the *mackerel;* five false finlets (*pinnæ accessoriæ*) on the back, and five or four of the same behind the anal fin; the scales are very small, almost invisible to the naked eye; this fish may attain a length of 2′, but is seldom longer than 16″. The mackerel is very common in the Mediterranean Sea, and occurs also in the Atlantic Ocean as far as 30° N.L.; also in the North Sea, perhaps to 61° N.L.; on the Dutch coast, especially in the middle of summer, from June to August. The common mackerel has no swimming-bladder, which however is present in other very similar species from the Mediterranean, *Scomber colias* Gm., Cuv., and *Scomber pneumatophorus* La Roche.

B. *Lateral line carinate, marked by aculeate shields or larger scales.*

Caranx (Commers., Lac. in part) Cuv. Body depressed. Lateral line loricate, or armed with spines throughout its whole extent or in posterior part. Teeth in jaws small, conical, crowded, sometimes larger in front row, in some none. Teeth in vomer and palate-bones very often small, acute, few. Branchiostegous membrane with seven rays. Pharyngeal teeth globose. Ventral fins thoracic. Dorsal fins two; an incumbent spine, pointing forwards in front of first fin, the second sometimes resolved into false fins. Two free spines in front of anal fin. Ventral fins thoracic.

Sp. *Caranx trachurus* Lac., *Scomber trachurus* Bloch, *Ichth.* Tab. 56, Cuv. *et* Val. *Poiss.* IX. Tab. 246; the *scad*, or *horse-mackerel;* teeth very small; second dorsal fin undivided; the shields along the lateral line begin close behind the head. This fish usually becomes 1′ long, although occasionally larger specimens of 16″ or more are captured. It is met with in the Mediterranean Sea, the North Sea, and in the Atlantic Ocean as far as the Cape of Good Hope, and even in the Indian Sea. There are however different varieties, or perhaps species, which have been united under the same name.

In the other species of this numerous genus the lateral line is armed with shields in its hindmost part only. In some, of which Cuvier formed the sub-genus *Citula*, the first soft ray of the second dorsal and of the anal fins is produced into a long filament. Sp. *Caranx citula* Cuv., *Caranx cirrhosus* Ehrenb., Cuv. *et* Val. *Poiss.* IX. Pl. 250.

Vomer Cuv. (*Zeus* L. in part). Body compressed, high. Head compressed, declivous. Scales very small or inconspicuous, larger

in the lateral line. Teeth small in both jaws, crowded in a narrow zone; some very small teeth in vomer. In pharyngeal bones small, globose, crowded teeth. Rays of branchiostegous membrane seven. Dorsal fins either two, the anterior low, or short disjoined rays in place of anterior fin; the second, like the anal fin, with rays often elongate, filiform. Ventral fins thoracic.

Olistus Cuv. Lateral line almost parallel to back. The middle rays of second dorsal fin and of anal fin not branched, produced into very long filaments.

Sp. *Olistus malabaricus* Cuv. *et* Val. *Poiss.* ix. Pl. 251.

Vomer (*Scyris, Blepharis, Gallichthys* Cuv., *Argyreiosus* Lac., Cuv., *Vomer* Cuv.). Lateral line convex above pectoral fins, almost semicircular, then running straight in the middle of body to the caudal fin.

Sp. *Vomer vomer* nob., *Zeus vomer* L., *Abacatuia* Marcgr. *Hist. Nat. Brasil.* p. 161, Linn. *Mus. Ad. Frid.* Tab. 31, fig. 9, Bloch *Ichth.* Tab. 193, fig. 2; the second ray of the dorsal fin is prolonged into a filament longer than the body. This species lives on the East Coast of America, from New York to Brasil.

Vomer Gallus, Gallichthys major Cuv., *Zeus Gallus* (L.?) Russell, Bloch *Ichth.* Tab. 192, fig. 1, Cuv. *et* Val. *Poiss.* ix. Pl. 254; in the Indian Sea at the Sunda Islands, &c.;—*Gallichthys Ægyptiacus* Ehrenb., Guér. *Iconogr., Poiss.* Pl. 31, fig. 3. In this species the ventral fins also have much elongated rays. The ventral fins on the contrary are very short in *Vomer Brownii* Cuv., and the rays of the dorsal and anal fins are not prolonged[1].

Hynnis Cuv. Dorsal fin single, opposite to anal. Lateral line at the posterior part of tail loricate with spined shields. Remaining characters those of the preceding genus.

Sp. *Hynnis Goreensis*, Cuv. *et* Val. *Poiss.* ix. Pl. 257.

II. *Mouth protractile. Body compressed, high. Ventral fins thoracic in all.*

A. *Two contiguous dorsal fins. Caudal fin rounded.*

Zeus L. (in part), Cuv. Teeth very small, acute, subulate, crowded in a narrow belt in jaws, teeth few in vomer. Branchioste-

[1] There are different fossil species from the tertiary formation, which belong to the *Scomberoids*, especially in *Monte Bolca*. Very common amongst these is *Gasteronemus rhombeus* Agass., *Poiss. foss.* v. Tab. 2, with strongly projecting inferior margin of the belly, as in *Mene* (see below, p. 166), and the second ray of the ventral fin filiform, far surpassing the length of the body.

gous membrane with seven rays. Spines of first dorsal fin increased by a long filament. A row of osseous shields in the keel of belly, and at the sides of second dorsal fin. Lateral line incurved equably throughout its entire length, parallel to back. Scales small, oval.

Sp. *Zeus faber* L., WILLUGHB. Tab. s. 16, BLOCH *Ichth.* Tab. 41, GUÉRIN *Iconogr., Poiss.* Pl. 32, fig. 1; the skeleton figured in ROSENTHAL *Ichthyotom. Taf.* XIII. fig. 1, and AGASSIZ *Poiss. foss.* V. Tab. B, fig. 2; the *Dory, Sonnenfisch, la Dorée;* in the Mediterranean Sea and the Atlantic Ocean; in the North Sea this fish has the northern limit of its distribution, as it seems, at 54°. The colour of the fishes observed by me was, in agreement with CUVIER'S statement, bluish-grey (lead-coloured), and not a lively yellow as in the figure of BLOCH. Above and behind the pectoral fin is a large round black spot, surrounded by a ring of lighter colour and an outermost very black ring. In old individuals this spot is more undefined and dull. In the specimens also of *Zeus pungio* CUV. which I investigated, I saw the same spot. This species from the Mediterranean Sea is distinguished by a large spine from the scapula, which extends backwards above the gill-covers. CUV. *et* VALENC., *Poiss.* X. Pl. 280.

Capros LAC. Scales small, coarse, aculeate (ctenoid). Eyes very large. Branchiostegous membrane with five rays.

Sp. *Capros aper* LAC., *Zeus aper* L., *Perca pusilla* BRUENNICH, RONDELET *De Piscib.* p. 161, YARRELL *Brit. Fish.* I. p. 169, CUV. *et* VALENC. *Hist. nat. des Poiss.* X. Pl. 281, from the Mediterranean Sea. Whether this fish has so great an affinity with *Zeus* as to allow of its being placed next to that genus, appears to me very doubtful. The internal structure, too, is in many respects very different; there are, *ex. gr.* only two short pyloric appendages, which are so numerous in the rest of the *Scomberoids.* AGASSIZ would place this fish with *Datnia* amongst the *Percoids.* But near *Centriscus* amongst the *Aulostomes,* where it has also been proposed to arrange it, it would have been beyond doubt in a much less appropriate position than near *Zeus.*

B. *Dorsal fin single. Caudal fin forked.*

Lampris RETZIUS, *Chrysotosus* LAC. Scales small or moderate, deciduous. Teeth none. Branchiostegous membrane with seven rays. Dorsal fin with three undivided rays, the third ray longest. Ventral fins with numerous rays (14 or 15), elongate.

Sp. *Lampris guttatus* RETZ., *Zeus guttatus* BRUENN., *Zeus luna* GMEL., *Encycl. méth., Poiss.* Pl. 39, fig. 155, GUÉRIN *Iconogr., Poiss.* Pl. 32. fig. 2, YARRELL *Brit. Fish.* I. p. 173, CUV. *et* VAL. *Poiss.* X. Pl. 282, &c. This rare and beautifully ornamented fish, silver-coloured with white shining spots and deep-red fins, is found in the North Sea, and attains usually a length of more than 3', sometimes even more than 4'. The skeleton is circumstantially described and figured in its particulars by G. BAKKER in

his *Osteographia Piscium*, 1822, pp. 170—212. This fish feeds principally on *Cephalopods* and also on *Medusæ*.

Mene LACEP. Body much compressed, with back nearly straight, abdomen convex, prominent. Teeth very small, crowded in jaws. Branchiostegous membrane with seven rays. Anal fin low. Ventral fins with few and short rays, except the second, which is produced into a long filament. Caudal fin with lobes divaricate.

Sp. *Mene maculata* CUV., *Zeus maculatus* BL., *Mene Annæ Carolinæ* LACEP. *Poiss.* v. Pl. 14, fig. 2, BLOCH *Syst. Ichth.* Tab. 22, SCHLEGEL *Faun. Japon., Pisc.* Tab. 67, fig. 3; in the Indian Sea and at Japan.

Equula CUV. Teeth in jaws mostly small, setaceous. Branchiostegous membrane with five rays. Dorsal fin with several pungent rays (7—9). Ventral fins with a strong pungent ray. Scales small. Lateral line parallel to back.

Sp. *Equula insidiatrix, Zeus insidiator* BLOCH, *Ichth.* Tab. 192, figs. 2, 3; —*Equula fasciata* CUV., *Mém. du Mus.* I. Pl. 23, fig. 2, &c. This genus belongs to the eastern hemisphere and contains species from the Red Sea, the Indian Ocean and the Southern Pacific, all of small size.

Family XXXIX. *Squamipennes.* Body compressed, mostly high, covered with ctenoid scales. Teeth in jaws, sometimes also in palate. Dorsal and anal fins covered with scales, mostly thick, continuous with trunk. Ventral fins thoracic.

Scaly-finned fishes. All have a compressed body, and almost all a large swimming-bladder. They are in great part fishes from the tropical seas; one species alone occurs in the North Sea.

A. *Teeth in palate. Branchiostegous membrane with 7 rays.*

Scorpis CUV. Body oval, covered with small scales. Head short, scaly. Teeth crowded in a broad band, thin in jaws, with an outer row of larger, cylindrical, acute teeth. Teeth in palate-bones, vomer and tongue, sharp, short, crowded. Dorsal fin with several (10) short spines, the soft part acuminate anteriorly. Caudal fin lunate.

Sp. *Scorpis georgianus* CUV. *et* VAL. *Poiss.* VIII. Pl. 245, from the South Sea at New-Holland.

Brama CUV. (spec. of genus *Brama* BL., SCHN.). Body oval, attenuated posteriorly behind the dorsal and anal fins. Head compressed, truncato-declivous. Maxillary teeth subulate, acute, distant, in upper jaw with a single outer row somewhat larger; teeth of

second row larger in lower jaw. Teeth acute, thin, in a single row in palate-bones. Teeth in vomer and tongue none. Dorsal fin long, low, anteriorly higher, with only three spines. Scales moderate, covering the body, head, and vertical fins. Caudal fin deeply excised, with lobes acuminate, elongate.

Sp. *Brama Raji* Bl., Schn., Willughb. *Hist. Pisc.* Tab. v. fig. 12, Bloch *Ichth.* Tab. 273, Cuv. *et* Val. *Poiss.* vii. Pl. 190; the skeleton in Rosenthal *Ichthyotom. Taf.* xii. fig. 1; the back black, the sides bluish, the belly silver coloured, pectoral and ventral fins yellowish; the last small. This fish attains a length of 1½'—2½'; it occurs in the Mediterranean and also in the North Sea. The cranium has a high, erect crest, like that of *Coryphæna hippurus* L., which on the whole it resembles, although the rest of the skeleton is very different. There are five pyloric appendages; a swimming-bladder is not present.

Pempheris Cuv. (spec. of *Kurtus* Bl.). Body broad anteriorly, with abdomen convex, attenuate posteriorly, covered with large deciduous scales. Head scaly, short, with eyes very large. Teeth small, thin, crowded in jaws, in palate-bones and vomer. Dorsal fin short, acuminate, towards the fore part placed over the pectoral fins; anal fin long. Lateral line nearer to back, parallel with it.

Sp. *Pempheris mangula* Cuv., *Pempheris taitensis* ejusd. Cuv. *et* Val. *Poiss.* vii. Pl. 101 (according to Bleeker *Pempheris vanicolensis* and *Pemph. nesogallica* Cuv. ought to be united with it); in the Indian and Pacific Oceans, from the island of Mauritius to Otaheite;—*Pempheris mexicana* Cuv., Guér. *Iconogr., Poiss.* Pl. 26, fig. 2. To this genus belongs also *Kurtus argenteus* Bl., Schn. *Syst. Ichth.* Tab. 41.

Toxotes Cuv. Head flat above the very large eyes. Jaws, vomer and palate-bones rough with very small, short, crowded teeth. Lower jaw longer; gape of mouth large. Dorsal fin opposite to anal, remote towards the tail, furnished with four strong spines.

Sp. *Toxotes jaculator* Cuv., *Sciæna jaculatrix* Schlosser, *Scarus Schlosseri* Gmel., Lac., *Labrus jaculatrix* (sic) Lacep., *Coius chatareus* Buchan., *Fishes of the Ganges*, Pl. 14, fig. 34, Guérin *Iconogr., Poiss.* Pl. 26, fig. 3; in the sea, and in rivers, in the East Indies, at the Sunda Islands, the Moluccan Archipelago and New-Guinea. This fish throws drops of water upon insects that chance to be on water-plants, and thus causes them to fall into the water, in order to overpower them.

Pimelepterus Lac., Cuv. (*Xyster* Commers.). Scales large, covering body and head. Maxillary teeth of outer row broken at a right angle, sectorial by their anterior vertical portion, affixed by

their posterior horizontal portion; other small, thin teeth placed behind the outer. Vomer and palate-bones rough with small teeth. Dorsal fin long, beginning over ventral fins, with ten or eleven pungent spines, with its soft part opposite to anal fin.

Sp. *Pimelepterus Boscii* LAC., *Poiss.* IV. Pl. 9, fig. 1, CUV. *et* VAL., *Poiss.* VIII. Pl. 137, at Carolina;—*Pimelepterus altipinnis* CUV., GUÉRIN *Iconogr. Poiss.* Pl. 25, fig. 1; from New-Guinea, and different species from the Indian Ocean.

B. *Teeth in palate mostly none. Branchiostegous membrane with six or with five rays.*

Note.—CUVIER divided the *Squamipennes* according to the presence and the defect of palatine teeth, and disallowed these teeth to the following genera entirely. Yet in the skeleton of *Platax arthriticus* I observe some few acute teeth in the vomer, and in *Psettus rhombeus* very minute teeth are present in five parcels, namely, in the vomer, the palate and pterygoid bones. On this account I think that this character must be restricted to the majority, and have added another taken from the number of rays of the branchiostegous membrane.

Dipterodon CUV. Strong teeth with sharp flat margin, arranged in jaws in a single row, behind this row in upper jaw others small, short. Dorsal fins two contiguous (or dorsal fin deeply emarginate in front of soft rays).

Sp. *Dipterodon capensis* CUV. *et* VAL. *Poiss.* VII. Pl. 188.

Psettus COMMERS., CUV. Maxillary teeth crowded, very small, distinguishable rather by touch than sight. Body in some oval, in others very high, short. Dorsal and anal fins falciform, with the points only emergent of the pungent rays in the anterior part. Ventral fins with a small spine conspicuous, and one or a few soft rays, scarcely distinguishable. Scales moderate.

Sp. *Psettus Sebæ* CUV., *Chætodon rhombeus* BL., SCHN., SEBA *Thesaur.* III. Tab. 26, fig. 21, CUV. *et* VAL. *Poiss.* VII. Pl. 189, from the coast of Guinea; —*Psettus Commersonii, Monodactylus falciformis* LAC. *Poiss.* II. Pl. 5, fig. 4, &c.

Platax CUV. Teeth sharp, subulate or setaceous, densely crowded in jaws like a little brush. Body very high; dorsal and anal fins falciform, with pungent spines in the anterior margin immersed, almost concealed. Scales small. Ventral fins elongate.

Sp. *Platax Blochii* CUV., *Chætodon vespertilio* BLOCH, *Ichth.* Tab. 199, fig. 2; BLEEKER unites with this species *Platax Ehrenbergii* CUV., *R. Ani., éd. ill., Poiss.*, Pl. 42, fig. 1, which probably agrees with *Chætodon pinnatus* L.

Mus. Ad. Frid. Tab. 33, fig. 6. This species lives in the Red Sea and in the Indian Ocean, like *Platax teira* CUV., *Chætodon teira* BLOCH l. l. fig. 1, with which BLEEKER unites *Platax vespertilio japonicus* SCHLEG. *Faun. Japon., Pisc.* Tab. 43. The length of the dorsal and anal fins cannot supply a character, since these fins in old individuals become obtuse and rounded. See P. BLEEKER in the *Verh. van het Batav. Genootschap* XXIII. Deel, 1850.

Platax arthriticus CUV., *Chætodon arthriticus* W. BELL, *Philos. Transact.* for 1793, Pl. 6; Sumatra, Java. The skull is remarkable from a thick, high crest; many of the spinous processes and interspinal bones have tubercles or soft bony swellings. This species attains a very conspicuous size.

Amongst the fossil fishes of *Monte Bolca*, with many other *squamipennes*, species also of this genus occur, as *Platax altissimus* AGASS., *Poiss. foss.* IV. Pl. 41.

Chætodon L. (excl. of some species[1]). Body oval, often high. Teeth in jaws setaceous, crowded. Gape of mouth small. Ventral fins distinct. Palate edentulous.

Rock-fish. These fishes, mostly very beautifully coloured, of the tropical seas, are very numerous. The form is various, and in this respect even the species of the sub-genera or smaller groups differ from each other, so that there are transitions from the one form to the other. Four principal groups may be distinguished, round each of which other smaller sub-genera arrange themselves.

a) *Præoperculum armed at the lower part with a large spine directed backwards.*

Holacanthus LAC. (and *Pomacanthus* ejusd.). Dorsal fin single, caudal fin mostly rounded.

Sp. *Chætodon armatus* L., *Mus. Ad. Frid.* Tab. 33, fig. 5, BLOCH *Ichth.* Tab. 201, fig. 2; this and some other species with a very high body, and in that case without spinous rays in the dorsal fin (*Pomacanthus* CUV.), are from South America.—Others have an oval body, with a great number of spinous rays in the dorsal fin (13—15), and the præoperculum with a margin usually toothed (*Holacanthus* CUV.). Of this division species are found in both hemispheres; ex. gr. in the gulph of Mexico: *Chætodon ciliaris* L., *Mus. Ad. Frid.* Tab. 33, fig. 1, BLOCH *Ichth.* Tab. 214, GUÉRIN *Iconogr., Poiss.* Pl. 23, fig. 1;—*Chætodon nicobarcensis* BL., SCHN., *Holacanthus geometricus* LACEP., CUV., BLOCH *Syst. Ichth.* Tab. 50 (a small elegantly marked species), and *Chætodon imperator* BLOCH *Ichth.* Tab. 194, *Encycl. Méth., Poiss.* Pl. 93, fig. 284, are on the other hand from the E. Indies.

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[1] Compare above, *Dascyllus*, p. 132, *Acanthurus*, p. 139;—*Chætodon saxatilis* L. and *Ch. rotundus* L. belong to the genus *Glyphisodon* LAC., p. 132.

b) *Præoperculum unarmed.*

Ephippus Cuv. Dorsal fins two, or dorsal fin deeply emarginate in front of soft rays (*Taurichthys* Cuv.), posterior alone scaly.

Add sub-genera *Scatophagus* and *Drepane* Cuv.

Sp. *Chætodon argus* L., *Scatophagus argus* Cuv., Bloch *Ichth.* Tab. 204, fig. 1;—*Chætodon taurus, Taurichthys varius* Cuv. *et* Val. *Poiss.* vii. Pl. 181; both from E. Indies.—*Chætodon gigas* Parkinson, *Ephippus gigas* Cuv. from the east coast of America, from New York to Brasil. This species becomes 16″ long, which in this family is an extraordinary size. To this species belongs the club-shaped bone described and figured by Olearius (*Gottorfische Kunstkammer*, Schleswig, 1666, fol. p. 18, Tab. ix. fig. 3) and Wormius (*Mus. Reg. Hafniæ*, 1696, fol. p. 18, Tab. ix. fig. 2); it is the interspinal bone, much thickened downwards, to which the first two rays of the anal fin are attached. See a figure and description of the skeleton of this fish (erroneously given as *Chætodon faber*) in B. Wolf *Diss. de Osse peculiari, Wormio dicto.* Berolini, 1824, 4to.

Heniochus Cuv. Dorsal fin single, entirely scaly, with one or two anterior rays produced into a very long filament. Body high, short. (Branchiostegous membrane with four or five rays).

Sp. *Chætodon macrolepidotus* L. (and *acuminatus* ejusd., *Mus. Ad. Frid.* Tab. 33, fig. 3), Bloch *Ichth.* Tab. 200, fig. 1, from the Indian Sea, from the Island of Mauritius to New-Guinea. In another species the scales are very small (*Chætodon cornutus* L., *Zanclus cornutus* Cuv.).

Chætodon Cuv. Dorsal fin single, quite scaly; pungent rays subequal or anterior and posterior less. Tail short, caudal fin truncate. (Branchiostegous membrane with six rays.)

Sp. *Chætodon rostratus, Chelmon rostratus* Cuv., Linn. *Mus. Ad. Frid.* Tab. 33, fig. 2, Bloch *Ichth.* Tab. 202, fig. 1, Cuv. *R. Ani., éd. ill., Poiss.* Pl. 40, fig. 1; this fish besprinkles insects that sit on water-plants, like the *Toxotes* (see above, p. 167).

Chætodon chrysozonus K. and V. Hass. (*Chætodon enneacanthus* Cuv., *Chætodon labiatus* K. and V. H., *Chætodon melanopus* Cuv., auct. Bleeker) Cuv. *R. Ani., éd. ill.*, Pl. 38, fig. 2. Both these species are from the E. Indies, as is *Chætodon vagabundus* L., Bloch *Ichth.* Tab. 204, and some others.

From the western hemisphere there are of the Linnean species *Chætodon striatus* L., *Mus. Ad. Frid.* Tab. 33, fig. 7, Bloch *Ichth.* Tab. 205, fig. 1, and the small *Chætodon capistratus* L., *Mus. Ad. Frid.* l. l. fig. 4, Bloch l. l. fig. 9, the last named very common in collections.

Family XL. *Sparoidei* Cuv. (with the addition of *Mænoidei* ejusd.). Body compressed, elongate or oval, covered with large scales, not thick, ctenoid. Eyes large. Teeth mostly in jaws only;

palate edentulous, or small teeth in vomer. Rays of branchiostegous membrane mostly six. Opercles never spinose. Pectoral fins large, often falcate, protracted as far as the middle of body or further. Ventral fins thoracic. Caudal fin forked. Dorsal fin long. Lateral line parallel to back, continuous, mostly very distinct.

This family contains marine fishes, of which many species occur in the Mediterranean; only four or five of these species have been also observed in the North Sea. They have much affinity with the *Percoids*, but in these the palate-bones are mostly furnished with teeth, which is not the case here, and in very few do teeth occur on the vomer. Moreover in the *Sparoids* the opercular bones are without teeth or spines; at most the præoperculum is finely striated or incised at the margin. There are but few pyloric appendages, commonly four or five (in some six, in others only three). They have a very large swimming-bladder. TROSCHEL has lately drawn attention to the peculiarity which the scales present in this family. The striæ on the scales do not extend over their whole surface, as is usual, in a direction parallel to the margin, but at the sides of each scale they run obliquely or almost at right angles to the margin from the middle, and are the prolongations of the concentric striæ of the posterior part. TROSCHEL, however, observed similar scales in some other genera of fishes, *Mullus*, *Upeneus*, *Sillago*, *Apogon* and *Psettus*. TROSCHEL, *Ueber die Begrenzung der Familie der Sparoiden*, *Archiv für Naturgesch.* 1849, s. 382—386, Taf. 8.

To the character of the uninterrupted lateral line there is only one exception known in the new S. American genus *Acharnes* MUELL., TROSCH., in which also there are only five branchial rays, however on the other hand it belongs, from the protractile mouth, to the division of the *Mœnids*. See R. SCHOMBURGK *Reisen in Britisch-Guiana*, III. Thl. 1848, s. 622. A figure of this fish is in MUELLER *u.* TROSCHELL, *Horæ Ichthyolog.* III. Tab. v. fig. 3.

A. Mouth protractile. (Long pedicles of the intermaxillary bones received between the orbits.) *Mœnoidei* or *Mœnides*. Branchiostegous membrane with six rays.

Smaris CUV. (with addition of genera *Mœna* CUV. and *Cæsio* COMMERS., CUV.). Teeth small, crowded in a narrow belt in jaws. Dorsal fin single, long, in most nearly of the same height throughout its whole extent. Three elongate scales at the ventral fins, two acuminate, lateral, the third lanceolate, placed between the two fins.

Caudal fin lunate or forked. Body elongate, fusiform or oval. Pharyngeal teeth setaceous, crowded.

Cæsio Commers., Lac. Dorsal fin scaly throughout or at the base, beginning behind pectoral fins.

Sp. *Cæsio erythrogaster* Kuhl and V. Hass.; *Sparus cuning* Bloch, *Ichth.* Tab. 263, fig. 1, Cuv. *et* Valenc. *Poiss.* vi. Pl. 166. In this species Bleeker found in large specimens the vomer rough from very small teeth. He observed the same in a new species, which he names *Cæsio Pingalo* (*Verh. van het. Batav. Genootschap* xxiii. Deel, *Bijdrage tot de kennis der Sparoiden en Mœnoiden van den Soenda-Molukschen Archipel.*). This observation is for us an additional reason why we should not divide *Mœna* Cuv. as a genus from *Smaris*. All the species hitherto known of the sub-genus *Cæsio* are from the eastern hemisphere, from the Indian Ocean and some also from the Red Sea.

Smaris Cuv. Dorsal-fin not scaly, beginning over pectoral fins. Vomer in some edentulous, in others (*Mœna* Cuv.) furnished with a row of fine, crowded teeth.

Sp. *Smaris Mœna* nob., *Mœna vulgaris* Cuv., *Sparus Mœna* L.? Cuv. *R. Ani., éd. ill., Poiss.* Pl. 36, fig. 4 (icon capitis);—*Smaris* (*Mœna* Cuv.) *Osbeckii*, *Sparus tricuspidatus* Spinola, *Ann. du Mus.* x. Pl. 28, fig. 1;—species from the Medit. Sea.

Smaris vulgaris Cuv., *Sparus Smaris* L. in part, Bonap. *Faun. Ital. Pisc.* Tab. 90, fig. 2; Bonaparte distinguishes from this, under the name of *Smaris gracilis*, the fish described by Delaroche, *Ann. du Mus.* xiii. 1809, p. 344, Pl. 25, fig. 17;—*Smaris alcedo* Cuv., Guérin *Iconogr., Poiss.* Pl. 21, fig. 1, and some other species from the Medit. Sea. Species of this group occur also in the Atl. Ocean.

Gerres Cuv. Teeth small, crowded, in a narrow belt in jaws, teeth in vomer and palate-bones none. Dorsal fin inserted in a narrow groove, surrounded by erect scales. Anterior inferior pharyngeal teeth setaceous, the rest globose. Body compressed, with back and abdomen acute, breast flat in front of ventral fins. Præoperculum often denticulate. Protracted mouth, bent obliquely downwards, head with retracted mouth short in front of eyes. Caudal fin deeply bilobed.

Sp. *Gerres oyena* Cuv., *Labrus oyena* Forsk., *Labrus longirostris* Lac. *Poiss.* iii. Pl. 19, fig. 1;—*Gerres Plumieri* Cuv. *et* Val. *Poiss.* vi. Pl. 167, &c. Species from the Tropical Seas. Like the other fishes of this division, these species have three spinous rays at the anal fin; Bleeker has discovered a species at Java which has five such rays; he forms from it the genus *Pentaprion*; Sp. *Pentaprion gerreoides.*

Note.—Emmelichthys RICHARDS. and *Aphareus* CUV. appear to me doubtful genera or of uncertain position. Rays of branchiostegous membrane seven, and in *Emmelichthys* two distant dorsal fins. Mouth protractile into a horizontal tube; see BLEEKER, l. l. p. 26. *Aphareus* is distinguished by the mouth not protractile, with gape ample, dorsal and anal fins single, with last ray of both elongate. Comp. CUV. *et* VAL. *Poiss.* VI. pp. 485—491.

Sp. *Aphareus cœrulescens* CUV., *Caranxomorus sacrestinus* LACEP., *Labrus furca* ejusd. *Poiss.* III. Pl. 22, fig. 1, CUV. *et* VAL. *Poiss.* VI. Pl. 167 *bis;* hab. in Indian Ocean;—*Aphar. rutilans* CUV., habit. in Red Sea.

Chætopterus SCHLEG.—Habitus of *Aphareus,* but branchiostegous membrane with four rays.

Comp. *Faun. Japon., Pisc.* pp. 78, 79.

B. Mouth not protractile.—Rays of branchiostegous membrane six, in few five. Teeth none in vomer or in palate-bones. (*Sparoidei* CUV.) Genus *Sparus* ART., L. (excl. some species).

A. *Teeth some conical, others small, crowded.*

* *Cheeks scaly.*

Pentapus CUV. Teeth fine, short, crowded, in a narrow belt in both jaws; a few teeth larger, sharp, anterior. Three elongate scales at the ventral fins, two lateral, the third in the middle between them. Eyes large.

Sp. *Pentapus vittatus* CUV., *Sparus vittatus* BLOCH *Ichth.* Tab. 275, &c.

Dentex CUV. Maxillary teeth in several rows in the middle, at the sides large, conical in a single row; some of the anterior often larger, sharp.

Sp. *Dentex vulgaris* CUV., *Sparus dentex* L., BLOCH *Ichth.* Tab. 268, CUV. *et* VAL. *Poiss.* VI. Pl. 153; in the Mediterranean Sea. To this genus belong many species from the Atlantic Ocean, the Red Sea, and especially from the Indian Ocean. Many fossil species also from *Monte Bolca* are known.

** *Cheeks naked.*

Lethrinus CUV. (Posterior lateral teeth in some conical, in some rounded).

Sp. *Lethrinus nebulosus* EHRENB., *Sciæna nebulosa* FORSK., Red Sea; —*Lethrinus rostratus* K. and V. HASS., from the Indian Ocean, as are most of the species. Some are famed as great delicacies, as *Lethrinus centurio*

Cuv. et Val., *Poiss.* vi. Pl. 158, and the Japanese *Lethrinus hæmatopterus*, Schleg., *Faun. Japon., Pisc.* Tab. 38. This genus surpasses all the others of this family in the number of species.

B. *Teeth all small, sharp, crowded. Cheeks scaly.*

Cantharus Cuv. Teeth in outer row somewhat larger, conical; behind them others crowded, subulate.

Sp. *Cantharus vulgaris* Cuv., *Sparus cantharus* L., Cuv. *et* Val. *Poiss.* vi. Pl. 160, in the Mediterranean Sea;—*Cantharus griseus* Cuv., Yarrell *Brit. Fish.* i. p. 114;—*Cantharus Blochii* Cuv., *Sparus Brama* Bl. (not L.), Bloch *Ichth.* Tab. 269, from the Cape of Good Hope, &c.

C. *Teeth flat, sectorial. Cheeks scaly.*

Box Cuv. Teeth contiguous, in a single row, the upper emarginate or crenate at the apex.

Sp. *Box vulgaris, Sparus boops* L., Cuv. *et* Val. *Poiss.* vi. Pl. 161; Mediterranean Sea and Atlantic Ocean along the north coast of Africa, &c.

Scatharus Cuv. Teeth contiguous, in a single row, flat, acuminate towards the apex.

Sp. *Scatharus græcus* Cuv. *et* Val. *Poiss.* vi. Pl. 162 *ter;* Mediterranean Sea at the Grecian Archipelago.

Oblata Cuv. Teeth in outer row contiguous, anterior sectorial, those at the sides subulate; others minute, crowded behind that row.

Sp. *Oblata melanura* Cuv., *Sparus melanurus* L., Cuv. *et* Val. *Poiss.* vi. Pl. 162,*bis;* in the Mediterranean Sea; silvery grey; a black spot above on the tail, behind the dorsal fin.

Crenidens Cuv. Teeth sectorial, crenate, in a double row in jaws; others crowded, rounded, very minute behind those rows.

Sp. *Crenidens Forskalii* Cuv. *et* Val. *Poiss.* vi. Pl. 162 *quater.*

Melanichthys Schleg. (Comp. *Faun. Japon. Pisc.* p. 75.)

D. *Lateral teeth globose, with crown flat or rounded, resembling molars, arranged in a single row or in several. Cheeks scaly.*

Pagellus Cuv. Anterior teeth subulate, small, in several rows; lateral globose, in two or more rows.

Sp. *Pagellus erythrinus, Sparus erythrinus* L., Cuv. *et* Val. *Poiss.* vi. Pl. 150; Mediterranean Sea, also occasionally in the North Sea; Gronovius

has described a specimen that was captured at Scheveningen, *Mus. Ichth.* p. 38, No. 90;—*Pagellus centrodontus* CUV., *Sparus centrodontus* LA ROCHE, *Ann. du Mus.* XIII. Pl. 23, fig. 2, GUÉRIN *Iconogr., Poiss.* Pl. 20, fig. 1, YARRELL *Brit. Fishes* I. p. 107; KROEYER *Danm. Fiske,* I. p. 206; 18″ long or more; reddish, with a large black spot behind the head at the beginning of the lateral line. Some exotic species also from the Atlantic Ocean belong to this genus.

Pagrus CUV. Anterior teeth conical, middle strong, behind these small and crowded teeth. Lateral teeth globose, in two rows.

Sp. *Pagrus vulgaris* CUV., *Sparus pagrus* L. (in part), CUV. *et* VAL. *Poiss.* VI. Pl. 148; Mediterranean Sea, different species from the Red Sea and the Indian Ocean, &c.

Sparus L. (in part), nob., *Chrysophrys* CUV. Anterior teeth conical; lateral teeth globose, in three rows or more.

Sp. *Sparus Aurata* L. (in part), CUV. *et* VAL. *Poiss.* VI. Pl. 145; *la daurade, de goudbrasem,* the *gilt-head,* with a shining gold stripe between the eyes; in the Mediterranean Sea and the Atlantic Ocean. The figure which BLOCH has given as of this fish is, according to CUVIER, that of a young individual of *Chrysophrys globiceps* CUV., from the Cape of Good Hope. The species of this genus are numerous; SCHLEGEL has described and figured several from the sea at Japan.

In other specimens the place of the round lateral teeth is supplied by much larger oval teeth. See on the position and succession of these teeth in *Sparus aurata,* CUVIER *Hist. nat. des Poiss.* VI. p. 380, Pl. 163, figs. 3—12.

Sargus CUV. Anterior teeth broad, with crown narrow, transverse, resembling human incisors. Lateral teeth rounded, large, in several rows, more rarely in a single row. (*Charax* RISSO, CUV.)

Sp. *Sargus annularis* CUV., *Sparus annularis* L., LA ROCHE, *Ann. du Mus.* XIII. Pl. 24, CUV. *et* VALENC. *Poiss.* VI. Pl. 149; in the Mediterranean Sea, &c.

Family XLI. *Sciænoïdei.* Body compressed, mostly oblong. Scales ctenoid, mostly large, thin, flexile, covering body, opercles and cheeks, often also a part of ventral fins. Teeth in jaws; vomer and palate-bones smooth. Branchiostegous membrane with seven rays, sometimes six, or more rarely five. Ventral fins thoracic. Bones of head often furnished with exsert lines, circumscribing hollow areolæ; hence the form of the head tumid. Lateral line continuous, anteriorly incurved, convex, posteriorly straight, sometimes indistinct.

Umbre-fishes. Almost all the species of this large family are marine. Some however are captured at the mouth of rivers; a few live in fresh water (*Macquaria* Cuv., *Scolopsides cancellatus* Cuv. &c.). There is always a swimming-bladder, usually large, and often furnished with many, very composite appendages.

Compare Cuvier *Hist. nat. des Poiss.* v. Pl. 138, 139, and especially on the swimming-bladder of *Sciæna aquila, Mém. du Mus.* i. pp. 18—21, Pl. i. fig. 2, Pl. ii. iii.

The remarkable structure of the bones of the head, of which many, especially the frontal bone, the row of sub-orbital bones and the *præoperculum*, have in most species projecting lines, with cavities or depressions between them, may be found illustrated in Cuvier *et* Valenciennes, *Poiss.* v. Pl. 140; see also a figure of *Corvina nigra*, under the name of *Sciæna umbra*, in Rosenthal *Ichthyot.* Taf. xvii. fig. 1, and of *Umbrina vulgaris* Cuv., *Sciæna cirrosa* L., in Agassiz *Poiss. foss.* iv. Tab. k.

In many the ossicles of the auditory sac are very large; whence a subgenus has its name (*Otolithus*). The uneducated multitude, who are so ready to attribute miraculous powers to whatever is strange, thought in the times of Bélon, that the auditory ossicles of *Sciæna aquila*, worn at the neck, were a cure and a preventive of the colic. *De Aquatilibus*, Parisiis, 1553, p. 118.

Phalanx I. *Dorsal fin single, continuous, or slightly emarginate between the spines and the soft rays.*

Macquaria Cuv. Mouth edentulous. Branchiostegous membrane with five rays.

Sp. *Macquaria australasica* Cuv. *et* Val. *Poiss.* v. Pl. 131.

Lobotes Cuv. Body high, short. Head in front of eyes short, with snout declivous, sub-concave. Teeth small, crowded, thin. Margin of præoperculum denticulate. Branchiostegous membrane with six rays. Dorsal and anal fins produced into a rounded apex.

Sp. *Lobotes surinamensis* Cuv., *Holocentrus surinamensis* Bloch, *Ichth.* Tab. 243, along the east coast of America, from New York to Brasil;—*Lobotes erate* Cuv., *Règne Ani., éd. ill., Poiss.* Pl. 31, fig. 1, a species, much resembling the preceding, from the Indian Ocean, &c.

Glaucosoma Schl. Branchiostegous membrane with seven rays. Dorsal fin low anteriorly, with fewer pungent rays than in the preceding genus, with which in other respects it has much in common.

Sp. *Glaucosoma Burgeri* nob., *Glaucosoma* Schleg., *Faun. Japon., Pisc.* Tab. 27.

Note.—Here also would seem to be the place for a new genus from the Indian Sea near Celebes, *Labracinus* Mus. L. B. of which I think the description may be expected from Dr SCHLEGEL.

Genus *Polycentrus* MUELL., TROSCH. is unknown to me; is this its place? Rays of branchiostegous membrane six. Operculum armed with a spine. Præoperculum and first infraorbital bone denticulate. Anal fin with numerous spines. Caudal fin?

Sp. *Polycentrus Schomburgkii* M. and TR.; habit. in West Indies, Essequebo. See R. SCHOMBURGK *Reisen in Britsch Guiana*, III. Leipzig. 1848, p. 622.

Note.—In the preceding genera the caudal fin is rounded; but in the following genera of this phalanx it is almost always lunate or forked.

Latilus CUV. Head declivous. Teeth small, arranged in several rows in jaws. Branchiostegous membrane with six rays. Dorsal fin long, low, with somewhat few (6 or 7) flexile spines.

Sp. *Latilus doliatus* CUV., VAL., *Poiss.* v. Pl. 130, &c.

Pteronemus nob. (*Cheilodactylus* LAC.). Teeth small or setaceous, arranged in several rows, sometimes conical in external row. Branchiostegous membrane with five or six rays. Inferior rays of pectoral fins longer, not remote, articulate. Ventral fins placed a little behind pectoral, almost abdominal.

Sp. *Pteronemus cynœdus, Cheilodactylus fasciatus* LAC., *Cynœdus* GRONOV. *Zoophyl.* p. 64, No. 221, LAC. *Poiss.* v. Pl. 1. fig. 1, from the Cape of Good Hope (and from the East Indies?)—*Pteronemus zonatus, Cheilodactylus zonatus* CUV. *et* VALENC. *Poiss.* v. Pl. 129, *Faun. Jap., Pisc.* Tab. 29. Here the dorsal fin, which in the preceding species was almost of uniform height, is very low in front of the soft rays, and then becomes higher. In a South American species, *Cheilodactylus cinctus*, figured by V. TSCHUDI, this is still more remarkably the case, and V. TSCHUDI even speaks here of two dorsal fins. *Fauna Peruana*, St Gallen, 1844, 4to, *Fische*, Tab. II.

Scolopsides CUV. Teeth in jaws subulate, very thin, crowded in a narrow row. Præoperculum denticulate. Branchiostegous membrane with five rays. Two suborbital spines, one directed backwards, decussating the other directed forwards.

Sp. *Scolopsides lycogenis* CUV., CUV. *et* VAL. *Poiss.* v. Pl. 127; *Scolopsides Vosmeri* CUV., *Anthias Vosmaeri* BLOCH, *Ichth.* Tab. 321, *Dictionn. univ. d'Hist. nat. Poiss.* Pl. 6, fig. 2, and other species from the Indian Sea. Some species occur also in the Red Sea.

Heterognathodon BLEEKER. Suborbital bones smooth, without any spine. Jaws with setaceous teeth in many rows, and a few anterior large, conical (canines). Other characters those of the preceding genus.

Sp. *Heterognathodon bifasciatus, Scolopsides caninus* CUV.? and two new species from the Indian Ocean. Compare *Verh. van het. Batav. Genootsch.* XXIII. 1849.

Pristipoma nob. Teeth subulate, thin, numerous, in several rows, larger in outer row. Præoperculum denticulate. Branchiostegous membrane with seven rays. Pharyngeal teeth conical, strong. Pores under lower jaw.

Hæmulon CUV. Scales in the soft part of dorsal and anal, and in the forked caudal fin.

Sp. *Pristipoma elegans, Anthias formosus* BLOCH, *Ichth.* Tab. 323, CUV. *R. Ani., éd. ill., Poiss.* Pl. 30, fig. 1;—*Pristipoma formosum, Perca formosa* L., *Labrus Plumieri* LACEP. *Poiss.* III. Pl. 2, fig. 2, and some other species from the West Indies and Brasil.

Pristipoma CUV. Fins not scaly. Two pores under the apex of lower jaw; a middle groove behind them, as in the preceding subgenus, from which it scarcely differs. Caudal fin mostly truncate or lunate.

Sp. *Pristipoma Commersonii* CUV., *Labrus Commersonii* LAC., and *Lutjanus microstomus* ejusd., LACEPÈDE *Poiss.* III. Pl. 23, fig. 1; Pl. 34, fig. 2; at Madagascar in the mouth of rivers;—*Pristipoma japonicum* CUV., SCHLEG. *Faun. Japon., Pisc.* Tab. 26, fig. 2, and many other species from the Indian Sea and some from the western hemisphere.

Diagramma CUV. Fins not scaly. Six pores under lower jaw.

Sp. *Pristipoma orientale, Anthias orientalis* BLOCH, *Ichthyol.* Tab. 326, fig. 3, *Diagramma orientale* CUV., VAL. *Poiss.* V. Pl. 124; a small fish from the Indian Archipelago, marked black and yellow, with round caudal fin;—*Pristipoma pictum* nob., *Diagramma punctatum* EHRENB., CUV. (and *Diagramma pictum et cinereum* sec. BLEEKER), Red, Indian and Japan Seas;—*Pristipoma plectorhynchum, Plectorhynchus chætonoides* LAC., *Poiss.* II. Pl. 13, fig. 2, &c.

Note.—Here also is to be inserted sub-genus *Chilotrema* TSCHUDI, *Faun. Peruan., Ichth.* p. 13, Tab. 1.

Phalanx II. *Dorsal fins two, or dorsal fin single deeply incised between the spines and the soft rays.*

a) *Margin of præoperculum entire. Ventral fins jugular; soft part of dorsal fin long. No cirri under jaw.*

Eleginus Cuv. Gape of mouth small, with teeth very thin, arranged in several rows. Branchiostegous membrane with six rays. Anal fin long.

Sp. *Eleginus maclovinus* Cuv., Valenc. *Poiss.* v. Pl. 115.

Nebris Cuv. Gape of mouth ample, with teeth small, arranged in several rows. Eyes small. Branchiostegous membrane with seven rays. Anal fin small, opposite to the last part of dorsal fin. Caudal fin rounded or rhombic.

Sp. *Nebris microps*, Cuv. *et* Val. *Poiss.* v. Pl. 112, from W. Indies.

b) *Margin of præoperculum denticulate or crenate. Ventral fins thoracic.*

Eques Bloch. Body compressed, high anteriorly. Teeth subulate, small, crowded. Branchiostegous membrane with seven rays. First dorsal fin high, falcate, second low, long; this last, as well as caudal and anal fins, scaly. Caudal fin rounded. No cirri under jaw.

Sp. *Eques punctatus* Bloch. *Syst. Ichth.* Tab. iii. fig. 2, Cuv. *et* Valenc. *Poiss.* v. Pl. 116, from the West Indies, as is also *Eques balteatus* Cuv., *Chætodon lanceolatus* L., *Eques americanus* Bloch, Cuv. *R. Ani., éd. ill., Poiss.* Pl. 29, fig. 2, which also occurs at Brasil.

Boridia Cuv. Genus of uncertain position.

Sp. *Boridia grossidens* Cuv., Cuv. *et* Val. *Poiss.* v. Pl. 114, from Brasil. Teeth globose, in several rows as in *Spari*.

Sciæna L. Teeth subulate, crowded sometimes only in upper jaw, in a single row in lower. Branchiostegous membrane with seven rays. Anterior dorsal fin short, scarcely or not surpassing the other in height. Caudal fin mostly truncate, or rounded, more rarely emarginate or lunate.

a) *Lower jaw cirrose.*

Micropogon Cuv. Cirri very small, few under jaw.

Sp. *Sciæna undulata, Perca undulata* L., Catesby, *Carol.* ii. Tab. 3, fig. 1, figure re-engraved in *Encycl. méth., Poiss.* Pl. 54, fig. 209; N. America in the large lakes. The other species also of this sub-genus are from the western hemisphere.

Pogonias Cuv., Lac. Several slender cirri, by the sides of lower jaw. Pharyngeal teeth globose, large.

Sp. *Sciæna chromis* LAC., *Pogonias chromis* CUV., *Labrus chromis* L., *Sciæna glyas* and *Sciæna fusca* MITCH. (according to CUV.), CUV. *R. Ani., éd. ill., Poiss.*, Pl. 29, fig. 1;—*Pogonias fasciatus* LAC., *Poiss.* II. Pl. 16, fig. 2, CUV. *et* VAL. *Poiss.* V. Pl. 118. The fishes that belong to the sub-genus *Pogonias* often accompany ships and then produce a loud sound. Hence the name *drum*, which the North-Americans have given to them.

Lonchurus BL. (excl. of some species), CUV. Two cirri under the jaw. Teeth thin, crowded in both jaws.

Sp. *Lonchurus barbatus* BLOCH, *Ichth.* Tab. 359.

Umbrina CUV. Single cirrus under the symphysis of lower jaw. Teeth thin, mostly equal, crowded in a broad belt. Upper jaw obtuse, longer than lower.

Sp. *Sciæna cirrosa* L., *Umbrina vulgaris* CUV., BLOCH *Ichth.* Tab. 300, CUV. *R. Ani., éd. ill., Poiss.* Pl. 28, fig. 3, in the Medit. Sea, &c.

b) *Lower jaw without cirrus.*

Corvina CUV. Second spine of anal fin large, thick. Teeth crowded, often larger in the outer row.

Sp. *Sciæna nigra* GMEL., *Corvina nigra* CUV., BLOCH *Ichth.* Tab. 297, CUV. *R. Ani., éd. ill., Poiss.* Pl. 28, fig. 1; in the Medit. Sea. There are many exotic species; in the Indian species the second spine of the anal fin is generally shorter; they form in part the genus *Johnius* BLOCH. The sub-genus *Lepipterus* CUV. (Sp. *Lepipterus Francisci* CUV., VAL. *Poiss.* V. Pl. 113) has a very elongate form and scales on the second dorsal and the caudal fins. According to T. T. REINHARDT this sub-genus is identical with *Pachyurus* AGASSIZ, a name to be preferred from its priority.

Otolitus CUV. (and *Ancylodon* ejusd.). Teeth conical, unequal, in the anterior row few, small or very small, the posterior teeth crowded, in the middle of each jaw. The two middle upper teeth long, tearing.

Sp. *Otolithus maculatus* KUHL and V. HASSELT, CUV. *R. Ani., éd. ill., Poiss.* Pl. 27, fig. 2, in the Indian sea; BLEEKER has recently made known three new species of this division, from the Sunda-Moluccan Archipelago.

Sciæna ancylodon, Ancylodon jaculidens, Lonchurus ancylodon BLOCH, *Syst. Ichth.* Tab. 25, from Surinam.

Sciæna CUV. Teeth conical, subincurved, distant, in a single row in both jaws; others very small behind the former in upper jaw, in the lower jaw interposed between the larger in the same row. Anal fin with a single, slender pungent ray, or with two very short.

Sp. *Sciæna aquila* CUV., *Sciæna umbra* L. (in part), BONAP., CUV. *Mém. du Mus.* I. pp. 1—21, Pl. 1, fig. 1, *R. Ani., éd. ill., Poiss.* Pl. 27, fig. 1,

YARRELL *Brit. Fish.* I. p. 90; *Sea-Perch, Umbrina* or *Ombrina* of the Italians, *Aigle, Maigre,* in the Medit. Sea and North Sea; becomes 5 or 6 feet long, and was formerly in high esteem in Italy. We have already remarked above on the swimming-bladder of this fish. The stomach is very long; there are 9 (or, according to CUVIER, 10) large and wide pyloric appendages; the last part of the intestinal tube is very narrow.

Note.—On some other sub-genera, omitted here, comp. CUV. *et* VAL., *Poiss.* Tom. v.

Family XLII. *Mugiloidei.* Body elongate, scaly, with two dorsal fins, almost always small, distant; the first with pungent spines nearly in the middle of back, the other supported by soft rays, almost opposite to anal fin. Caudal fin forked. Ventral fins abdominal, placed before the first dorsal. Teeth small, very thin, sometimes none. Eyes large. (Branchiostegous membrane with six rays, more rarely with five.)

Tetragonurus RISSO, CUV. Scales arranged in oblique rows, surrounding the body verticillately. Anterior dorsal fin long, low, with numerous spines. Teeth conical, in a single row in jaws; teeth acute in vomer and palate-bones. Tail in front of fin bicarinate on each side. Branchiostegous membrane with five rays.

Sp. *Tetragonurus Cuvierii* RISSO, *Mugil niger* RONDELET, *Corvus niloticus* ALDROVANDI *de Piscib.* (ed. Francof.), p. 236, Tab. 26, fig. 14, CUV. *et* VAL. *Poiss.* XI. Pl. 318; from the Medit. Sea; this species becomes 13″ long, and seems to be rare. It has many pyloric appendages and no swimming-bladder. In some respects this genus approaches the *Notacanthini* (see above, p. 151); the hard scales disposed in oblique rows recall the *Ganolepidoti, Lepidosteus* and *Polypterus.*

Mugil L. Body and head scaly. Opercles large, smooth, thin, gibbous. Scales large (ctenoid), rough posteriorly with small denticles. Head flat above; eyes remote from each other. Body elongate, with back almost straight. Mouth small; lower jaw with a longitudinal crest, exsert internally, received in the excised margin of upper jaw. Maxillary teeth in a single row, very thin, sometimes none; vomer and palate-bone edentulous. Two dorsal fins distant, small, the first with four spines.

Sp. *Mugil capito* CUV., YARRELL *Brit. Fish.* I. p. 200, in the Medit. Sea and the N. Sea; LINNÆUS confounded this species with *Mugil cephalus,* GUÉRIN *Iconogr., Poiss.* Pl. 37, fig. 1; on the different species in the Medit. Sea, see CUV. *et* VAL. Tom. XI. Different exotic species are known, especially from the Indian Sea. In this genus there is a large swimming-

bladder. There are only two pyloric appendages and the pyloric portion of the stomach has thick muscular walls. Sometimes the first dorsal fin has accidentally in one or another species five rays; LINNÆUS has given this, incorrectly, as a specific character of *Mugil cephalus*.

Atherina L. Body elongate, with back sub-convex. Scales moderate, cycloid. Mouth protractile. Small teeth in jaws, often also in palate. Branchiostegous membrane with six rays. Two dorsal fins small, distant; the first with 4—9 spines, mostly six or seven. Body with a silvery lateral band.

These fishes are small; they have a swimming-bladder, but no pyloric appendages. With much external resemblance to the preceding genus, they differ from it in the scales, which AGASSIZ has described (*Rech. s. les Poiss. foss.* I. p. 8, 83), and in anatomical particulars.

Sp. *Atherina hepsetus* L., CUV. *et* VAL. *Poiss.* X. p. 302, fig. 1, in the Medit. Sea and the Black Sea, also in the Atlantic Ocean along the Northern coast of Africa;—*Atherina presbyter*, CUV., GUÉRIN *Iconogr., Poiss.* Pl. 37, fig. 3, YARRELL *Brit. Fish.* I. p. 214, from the North Sea, &c.

Family XLIII. *Aspidoparei* (*Cataphracti* MUELL.). Body compressed or fusiform, with head mostly large, aculeate. Suborbital bones large, conjoined posteriorly with the præoperculum, covering the cheeks with a shield. Scales ctenoid, often small, oval. Teeth crowded, mostly thin in jaws, often also in vomer and palate-bones. Ventral fins in most thoracic or jugular, in few abdominal.

Mail-cheeked fishes (*joues cuirassées* CUV.). These fishes have much resemblance to the Perches. In some, according to the observations of J. MUELLER, there are only three gills and a half present, and the fissure behind the last branchial arch is wanting. This character, however, cannot well serve for dividing the family, for then *Pterois*, for instance, would be separated from *Scorpæna*, and each of these nearly allied genera be placed in a different division.

Phalanx I. *Free spines in front of dorsal fin, which is supported by soft rays.*

Gasterosteus L. (exclus. of some species). Jaws with very small, crowded teeth; palate edentulous. Branchiostegous membrane with three rays. Body at the sides often covered with transverse osseous scutes, elsewhere scaleless. Tail carinate on both sides. Ventral

fins abdominal, with a strong spine, and one, sometimes two short, soft rays. Bones of pelvis large, forming an abdominal sternum.

Sp. *Gasterosteus Spinachia* L., BLOCH *Ichth.* Tab. 53, fig. 1, *Skandinaviens Fiskar.* Tab. 4, fig. 3; the *sea stickleback;* 14 or 15 free spinous rays on the back; the head long, body much elongated; becomes 5″ or 6″ long; occurs in the N. Sea, YARRELL *Brit. Fish.* I. p. 87.

Gasterosteus pungitius L., BLOCH *Ichth.* Tab. 53, fig. 4, *Skandinaviens Fiskar.* Tab. 4, fig. 2; the *stickleback,* our smallest fresh-water fish, is not more than 2½″ long, and has from 8 to 10 spines on the back. Another species, which is somewhat larger, has only 3 spines on the back: *Gasterosteus aculeatus* L. *Skandinav. Fisk.* Tab. 4, fig. 1, *a, b.* In this species there are bony plates at the sides which in *Gast. pungitius* are wanting; they extend more or less backwards over the tail, in which respect transitions are observed, which render the establishment of two species (*Gasterosteus trachurus* and *leiurus* CUV.) less acceptable.

Monocentris BL., SCHN. (*Lepisacanthus* LACEP.). Teeth short, thin, crowded in jaws and in palate-bones, none in vomer. Branchiostegous membrane with eight rays. Body short, compressed, with scales large, hard, carinate, rough. Pungent rays thick in back. Ventral fins with a very strong spine, and three very small soft rays.

Sp. *Monocentris carinata* BL., SCHN., *Gasterosteus japonicus* HOUTTUYN, *Verh. van de Maatsch. der Wetensch. te Haarlem.* XX. 2e Stuk, blz. 329, 330, *Sciæna cataphracta* THUNB., BLOCH, SCHN. *Syst. Ichth.* Tab. 24 (fig. of THUNBERG), GUÉRIN *Iconogr., Poiss.* Pl. 16, fig. 1, SCHLEGEL *Faun. Japon., Pisc.* Tab. 22, fig. 1; from the Japan Sea; this species is eaten by the Japanese and is common with them, although it is only rarely found in European collections; it attains a length of only 5″.

Phalanx II. *Dorsal fin single. Ventral fins thoracic.* (Genus *Scorpæna* L.)

Synanceia BL., SCHN. Body scaleless, often warty. Head cavernous, tuberculate, mostly large. Eyes approximate in vertex. Teeth crowded, thin in jaws; vomer mostly edentulous, sometimes furnished with teeth (*Synancidium* MUELL.). Branchiostegous membrane with seven rays. Pectoral fins ample, with all the rays cloven at the point. (Branchiæ three and a half.)

Sp. *Synanceia horrida* CUV., *Scorpæna horrida* L., GRONOV. *Zoophylac.* Tab. 11—13, LAC. *Poiss.* II. Pl. 17, fig. 2, from the Indian Ocean, becomes about 8 or 9″ long;—*Synanceia brachio* CUV., LAC. *Poiss.* III. Pl. 12, fig. 1, BLOCH *Syst. Ichth.* Tab. 45, CUV. *R. Ani., éd. ill., Poiss.* Pl. 25, fig. 3; also from the Indian Ocean, from the Arabian gulph and the island of

Mauritius as far as New Guinea; this species becomes 10″ long;—*Synancœia elongata* Cuv., a species, not yet figured, also from the Indian Ocean, becomes only 3 or 4″ long and has a much smaller head than the other species.

Pelor Cuv. Teeth crowded, minute in jaws and vomer. Mouth directed obliquely upwards. Orbits pedunculate. Spines of dorsal fin elongate. Two free rays under pectoral fins. Other characters almost those of the preceding genus.

Sp. *Pelor obscurum* Cuv., *Scorpœna didactyla* Pall., *Spic. Zool.* vii. Tab. 4, from the Southern Pacific;—*Pelor japonicum* Cuv., Cuv. *et* Val. *Poiss.* iv. Pl. 93, and better *Faun. japon. Pisc.* Tab. 18, fig. 2, &c. Species from the western hemisphere of this as well as of the preceding genus are unknown hitherto.

Apistus Cuv. Head compressed, aculeate. Teeth small, thin, crowded in jaws and vomer; palatine teeth in some, in others (subgenus *Minous* Cuv.) none. Branchiostegous membrane with 5—7 rays. Branchiæ three and a half (Muell.). Suborbital bone and præoperculum armed with a very strong erectile spine. Body in some naked, in others scaly. Dorsal fin extending from head towards the point of tail. Free rays under the pectoral fins.

Sp. *Apistus trachinoides* Cuv., Cuv. *et* Val. *Poiss.* iii. Pl. 92, fig. 1, Indian Sea at Java;—*Apistus marmoratus* Cuv., *R. Ani., éd. ill., Poiss.* Pl. 24, fig. 3. East Indies at Timor; this species is without scales, &c. All the species are from the Eastern Hemisphere; small fishes from 2″ to 4″ long.

Agriopus Cuv. Body compressed, covered by skin naked, smooth or rough. Head in front of eyes descending almost strait to the small mouth. Teeth crowded, slender, in jaws, sometimes also in vomer. Branchiostegous membrane with five rays. Dorsal fin long, high anteriorly, beginning above the eyes or shortly behind the eyes and produced to the point of tail. Soft rays of fins not branched.

Sp. *Agriopus torvus* Cuv., *Blennius torvus* Gronov;—*Agriopus verrucosus* Cuv., Cuv. *et* Val. *Poiss.* iii. Pl. 91; both from the Cape of Good Hope. —*Agropus peruvianus* Cuv. *R. Ani., éd. ill., Poiss.* Pl. 25, fig. 1.

Haploactis Schleg. Dorsal fin higher posteriorly. Ventral fins triradiate. Præoperculum armed with several spines. Remaining characters nearly those of the preceding genus.

Sp. *Haploactis cottoides* nob., *Faun. Japon. Pisc.* Tab. 22, figs. 3, 4; a small fish about 3″ long.

Blepsias Cuv.

Sp. *Blepsias trilobus* Cuv., Val. *Poiss.* III. Pl. 90, *Trachinus cirrosus* Pall., on the coast of Kamschatka; from the same coasts is also *Blepsias bilobus* Cuv., *R. Ani., éd. ill., Poiss.* Pl. 24, fig. 2. This genus is very nearly allied to *Haploactis* Schleg.

Genus *Tænianotus* Lac., Cuv. Is it sufficiently distinct from *Agriopus?* Head compressed, aculeate, cirrose; body much compressed, covered with small scales. Dorsal fin high, of the length of back, joined to caudal. (Teeth...? Rays of branchiostegous membrane...?)

Sp. *Tænianotus triacanthus* Cuv., Val. *Poiss.* IV. Pl. 89, *R. Ani., éd. ill., Poiss.* Pl. 23, fig. 2; the specimen of uncertain origin, 3″ long.

Hemilepidotus Cuv.

Sp. *Hemilepidotus Tilesii* Cuv., *Cottus hemilepidotus* Tiles., Cuv. *et* Val. *Poiss.* IV. Pl. 85, *R. Ani., éd. ill., Poiss.* Pl. 22, fig. 2.

Pterois Cuv. Head compressed, aculeate, furnished with laciniated cirri. Teeth thin, short, crowded in jaws and vomer, none in palate-bones. Branchiostegous membrane with seven rays. Anterior rays of dorsal fin and rays of pectoral fins elongate; of these the first are sometimes produced as far as the caudal fin. Body covered with small scales.

Sp. *Pterois volitans* Cuv., *Gasterosteus volitans* L., *Scorpæna volitans* Gm., Bloch *Ichth.* Tab. 184, Bennett *Fishes on the Coast of Ceylon.* London 1830, Pl. 1, Cuv. *et* Val. *Poiss.* IV. Pl. 88, in the Red and Indian Seas;—*Pterois zebra* Cuv., *R. Ani., éd. ill., Poiss.* Pl. 24, fig. 1, in the Indian Sea, from the Island of Mauritius to New Guinea. All the species are from the Eastern Hemisphere.

Scorpæna L. (excl. *Scorpæna horrida*). Head compressed, covered by naked soft skin, aculeate, often cirrose. Eyes large. Teeth sharp, subulate, crowded in jaws, vomer and palate-bones, with a zone broad anteriorly in jaws. Body scaly. Rays of branchiostegous membrane seven. Branchiæ three and a half.

Sp. *Scorpæna scrofa* L., Bloch *Ichth.* Tab. 182; the skeleton in Rosenthal *Ichthyotom.* Taf. XV. fig. 2. This species attains a size of 1½′, at most of 2′;—*Scorpæna porcus* L., *Dict. univ. d'Hist. nat., Poiss.* Pl. 4, fig. 2; this species is smaller than the preceding and has smaller scales. Both occur in the Medit. Sea and the Atl. Ocean; the last comes now and then to the Canal.

Sebastes Cuv. Body scaly, without cirri. Remaining characters almost those of the preceding genus. Habitus of *Perca.*

Sp. *Sebastes norvegicus* Cuv., *Perca norvegica* O. F. Mueller, Cuv. *et* Val. *Poiss.* iv. Pl. 87, a fish from the N. Sea, which usually attains a length of fully 1′, and has a red colour; at Greenland, Iceland and along the coast of Norway;—*Sebastes variabilis* Cuv., *Perca variabilis* Pall., Guérin *Iconogr., Poiss.* Pl. 14, fig. 1, at Kamschatka.

Chirus Steller, *Labrax* Pall.

Sp. *Labrax leucogrammus, Labrax decagrammus* cet. Pallas *Mém. de l'Acad. de Petersbourg*, ii. 1810, pp. 382—398. Fishes from the sea between Northern Asia and America. Pores arranged in longitudinal rows on the body, as though the lateral line were multiplex. This genus is referred by Cuvier to the *Gobioïds*.

Phalanx III. *Two dorsal fins, the anterior supported by spines.*

† *Ventral fins situated behind pectoral, almost abdominal.*

Platycephalus Bl. (excl. of some species). Head much depressed, spinose; eyes in vertex, approximate. Lower jaw longer than upper. Teeth very thin, crowded in jaws, with the middle and posterior in upper jaw conical, larger; subulate teeth in a narrow belt in the anterior part of vomer, and in an oblique, longitudinal row on each side in palate-bones. Branchiostegous membrane with seven rays. Body scaly.

Sp. *Platycephalus insidiator* Bl., *Callionymus indicus* L., *Cottus spatula* Bloch, *Ichth.* Tab. 424, *Cottus madagascariensis* Lac. *Poiss.* iii. Pl. xi. figs. 1, 2; in the Red Sea and Indian Ocean;—*Platycephalus scaber, Cottus scaber* L., Bloch *Ichth.* Tab. 180;—*Platyc. grandispinis* Cuv., Guérin *Iconogr., Poiss.* Pl. 13, fig. 1, &c.

†† *Ventral fins thoracic (or subjugular).*

Bembras Cuv. Head spinose, with snout depressed, obtuse. Teeth thin, crowded in jaws, vomer and palate-bones. Branchiostégous membrane with seven rays. Body scaly.

Sp. *Bembras japonicus* Cuv. *et* Val. *Poiss.* iv. Pl. 83, *Faun. Japon., Pisc.* Tab. 16, fig. 8;—*Bembras curtus* Schleg. ibid. figs. 6, 7.

Cottus L. (excl. of some species). Head broader than body, depressed, spinose. Teeth thin, crowded in jaws. Branchiostegous membrane with six rays. Body attenuated posteriorly. (Branchiæ three and a half, with fourth arch adnate posteriorly.)

Agonus Bl., Schn. (*Aspidophorus* Lac., Cuv., *Phalangistes* Pall.). Body mailed with hard osseous scales, angulate. Ventral fins small, triradiate.

Sp. *Cottus cataphractus* L., *Aspidophorus europæus* Cuv., Bloch *Ichth.* Tab. 39, fig. 3, *Skandinaviens Fiskar.* Tab. 40, Yarrell *Brit. Fish.* i. p. 70; the *armed bullhead*, in the North Sea; about 6″ long. This species, like most others of this northern sub-genus, has two dorsal fins, and no other teeth than those of the intermaxillary bone and the lower jaw.

There is another species from the high north (above 60 N. L.), which has only a single dorsal fin, far from the tail, and which is distinguished by teeth in the palate and vomer, *Agonus monopterygius* BLOCH, *Ichth.* Tab. 178, figs. 1, 2, CUV. *et* VAL. *Poiss.* VI. Pl. 169.

Cottus CUV. Body fusiform, mostly quite scaleless or covered at the sides with scales. Teeth in the anterior part of vomer. Ventral fins small, mostly with four rays, sometimes five or three.

Sp. *Cottus gobio* L., BLOCH *Ichth.* Tab. 39, figs. 1, 2, *Skandinav. Fiskar.* Pl. 7, fig. 2; in fresh water; there are five rays in the ventral fins; this species is small, not much above 4" long.—*Cottus scorpius* L., BLOCH *Ichth.* Tab. 40, *Skandinaviens Fiskar* Pl. 5, YARRELL *Brit. Fish.* p. 60; the *sea-scorpion* (*donderpadde* Dutch, *Rötsimpa* Swedish, *Ulk* Danish); the *præoperculum* has usually four spines, of which the uppermost is the longest, but does not reach to the extremity of the large spine of the *operculum;* the upper jaw mostly extends slightly beyond the lower. This species becomes 8—10" long, and occurs on the west coast of France, and as far as Iceland in the North Sea.

In some exotic species teeth are found on the palate-bones in addition to those on the vomer. *Cottus asper* RICHARDSON, *Fauna boreali-Americ., Fishes,* Pl. 95, fig. 1, *Cottus uncinatus* SCHL., *Faun. Jap. Pisc.* p. 38. From this RICHARDSON has formed the sub-genus *Centridermichthys.* The skin is rough from small warty inequalities or spines; the præoperculum has a spine directed upwards. Here belongs, as it seems, also *Cottus platycephalus* PALL.

Uranidea DEKAY.

Hemitripterus CUV. Head sub-depressed, aculeate, armed with many jagged cirri. Teeth sharp, crowded in jaws, vomer and palate-bones. Branchiostegous membrane with six rays. Anterior dorsal fin deeply emarginate. Body scaleless.

Sp. *Hemitripterus americanus* CUV., *Cottus tripterygius* and *hispidus* BLOCH, *Syst. Ichth.* Tab. 13, CUV. *R. Ani., éd. ill., Poiss.* Pl. 22, fig. 1; on the coasts of N. America.

Pungitius L. (*Mus. Ad. Frid.*), *Cephalacanthus* LAC. Head obtuse anteriorly, flat above, with a long lateral spine on each side produced to the base of dorsal fin. Eyes large. Præoperculum armed with a long spine, directed backwards below the pectoral fins. A row of very small teeth in jaws. Branchiostegous membrane with three rays. Pectoral fins small, bifid. Body covered with keeled scales.

Sp. *Pungitius pusillus* L. (*Gasterosteus spinarella* L. *Syst. nat.*), *Mus. Ad. Frid.* Tab. 32, fig. 5, CUV. *R. Ani., éd. ill., Poiss.* Pl. 20, fig. 4; a small fish from the east coast of tropical America.

Dactylopterus LAC. Teeth conical, short, rounded at the apex, crowded in jaws, none in vomer or palate-bones. Branchiostegous membrane with six rays. Pectoral fins bifid, the posterior part with very long, simple rays, forming a wing. (Remaining characters almost those of the preceding genus.)

Flying fishes, like the genus *Exocoetus;* see above, p. 110. There is a species in the Mediterranean Sea and the Atlantic Ocean, *Dactylopterus vulgaris, Trigla volitans* L., BLOCH *Ichth.* Tab. 351, and one in the Indian Ocean; from the Island of Mauritius to the Sunda Islands, which also extends itself to the east coast of Asia, at China and Japan, *Dactyl. orientalis* CUV. *et* VAL. *Poiss.* IV, Pl. 76, SCHLEGEL *Faun. Jap., Pisc.* Tab. XV. A. This genus differs from the otherwise nearly allied genus *Pungitius,* not only in its elongated pectoral fin-rays, but also in its much larger size; they attain a length of more than a foot. The Indian species has a long free ray of the dorsal fin on the back of the head, and is of a red colour with yellow-green, round spots; the pectoral fins are blue. The cranial bones are thick and porous on the surface.

Trigla L. (excl. of *Trigla volitans*). Head from vertex to mouth very declivous, loricate, armed with rugged crests. Branchiostegous membrane with seven rays. Pectoral fins ample, with two or three inferior rays free (*digiti* LINN.).

A. *Fingers three. Teeth small, crowded, thin in jaws and in the anterior part of vomer. Body scaly.*

Trigla nob. (*Trigla* recentiorum and *Prionotus* LAC.)

Gurnards, Knurrhahnen of the Germans, *Grondins* of the French. These fishes feed principally on crustaceans. Their swimming-bladder is large, oval, with stiff walls. They have a pretty long intestinal canal with thin tunics, but the wide stomach has thick walls. There are 5—10 pyloric appendages.

Some species (all from the western hemisphere) have large pectoral fins, which extend almost as far as behind the second dorsal fin, and teeth in the palate-bones. Here belong *Trigla evolans* and *Trigla carolina* L. In most of the species the pectoral fins are smaller and extend only as far as the beginning of the second dorsal fin; they have no teeth in the palate, except those of the vomer. Sp. *Trigla hirundo* L., BLOCH *Ichth.* Tab. 60; red, with dark violet, very large pectoral fins; this species becomes two feet long;—*Trigla gurnardus* L. (and *Trigla hirundo* L. in part), *Skandin. Fiskar.* Pl. 3, fig. 2, YARRELL *Br. Fish.* I. p. 48, the *grey* or *small gurnard;* this species is rarely more than 1′ long; the lateral line has larger and carinate scales. There are different species also of this genus in the Mediterranean Sea, and some in the Atlantic Ocean and in the Southern Pacific at New Zealand. The exotic species, however, are not numerous. *Trigla alata* HOUTTUYN, a Japonese species, is not clearly to be determined, perhaps *Trigla Burgeri, Faun. Jap.*

B. *Fingers two. Mouth and palate edentulous.*

Peristedion LAC. Snout furcate, elongate. Body mailed with large, bony, keeled scales. Several branched cirri at the lower jaw.

Sp. *Trigla cataphracta* L., RONDELET *de Piscib.* p. 299 (*Cornuta sive lyra altera*), CUV. *R. Ani., éd. ill.*, Pl. 20. fig. 3, from the Mediterranean Sea. A figure of the cranium in ROSENTHAL *Ichthyotom.* Taf. XVIII. fig. 4. A species also from Japan is known, *Peristedion orientale* SCHL. *Faun. Japon.*; and a few years ago the *Rijks-Museum* received one from the Indian Sea, at the Moluccas, through the deceased FORSTEN (*Peristedion laticeps*, n. sp.)

Oreosoma CUV. Body compressed, high, scaleless, furnished with conical tubercles on the back and at the belly. Mouth vertical; teeth small, thin, crowded in jaws, vomer and palate-bones. Branchiostegous membrane with seven rays.

Only one species of this anomalous genus is known, *Oreosoma coniferum* (or *atlanticum*) CUV., a small fish, discovered by PÉRON; GUÉRIN *Iconogr., Poiss.* Pl. 16, fig. 3, CUV. *R. Ani., éd. ill., Poiss.* Pl. 26, fig. 4.

Family XLIV. *Percoidei.* Body oblong, covered with rough scales (ctenoid). Præoperculum or operculum rough with teeth or spines. Teeth in jaws and vomer, often also in palate-bones. Branchiostegous membrane mostly with seven rays. Ventral fins thoracic in most.

Percoïd fishes. This large family contains principally the different sub-divisions which modern writers have adopted in the large genus *Perca* of LINNÆUS, to which are added some smaller genera of the great Swedish naturalist, *Uranoscopus*, *Trachinus*, *Polynemus* and *Mullus*. The most aberrant is the last-named genus, which we therefore place in a division distinct from the rest; it has some conformity with the Sparoïds.

Section I. *Mullini.* Two cirri in lower jaw. Branchiostegous membrane with four rays.

Mullus L. Head compressed, scaly. Eyes large at the top of head, remote from mouth. Body covered with large, deciduous scales. Ventral fins thoracic.

Upeneus CUV. Teeth in both jaws.

Note.—All the species of *Upeneus* are extra-European marine fishes. BLEEKER distinguishes the sections of this genus of CUVIER as sub-genera;

one section, with maxillary teeth in a single row, palatine and vomerine teeth none, this he calls *Upeneus:* another, with maxillary, palatine and vomerine teeth in several rows, very small, under the name, not the best, of *Upeneoides:* finally a third, with a similar name, *Mulloides*, where the maxillary teeth are in several rows, and without teeth in palate-bones.

Sp. *Upeneus lateristriga* Cuv., Lac. *Poiss.* III. Pl. 13, figs. 1, 2, Cuv. *R. Ani., éd. ill., Poiss.* Pl. 19, fig. 3;—*Upeneus Vlamingii* (*Upeneoides* Bleek.), Cuv. *et* Val. *Poiss.* III. Pl. 71; from the Indian Ocean.

Mullus Cuv. Teeth in upper jaw none, crowded in lower jaw and vomer.

Sp. *Mullus surmuletus* L., Bloch *Ichth.* Tab. 57, Cuv. *R. Ani., éd. ill., Poiss.* Pl. 19, fig. 2;—*Mullus barbatus* L., Bloch *Ichth.* Tab. 348, fig. 2, (this figure gives erroneously teeth in the upper jaw), Cuv. *et* Val. *Poiss.* Pl. 70. Both these species in the Mediterranean Sea and also in the Atlantic Ocean, and now and then (especially the first) in the North Sea. These species have no swimming-bladder, whilst in most of the species of *Upeneus* that organ is very large.

The Romans made much ado about this fish, and often paid unprecedented sums for large *Mulli* of two or more pounds, (*Mullus bilibris*, Martial. Lib. xi. 50, v. 9, Lib. iii. 45, v. 5; *trilibris*, Horat. *Satirar.* Lib. ii. 2, v. 33). The *Mullus barbatus* was kept by them in *vivaria;* they amused themselves with the beautiful red colour of the fish, as we do with the gold fish (*Cyprinus auratus*); they caused them to be exhibited alive to their guests at table before they were set before them: "*Vitreis ollis inclusi offeruntur, et observatur morientium color, quem in multas mutationes mors luctante spiritu vertit, alios necant in garo et condiunt vivos.—Nihil est mullo exspirante formosius,*" &c. Seneg. *Nat. Quæst.* L. iii. c. 17, 18.

Section II. *Percini.* No cirri in lower jaw. Rays of branchiostegons membrane more than four.

A. *Ventral fins abdominal* (*a little more posterior than pectoral*).

Sphyræna Artedi, Bl., Schn. Body elongate, covered with small scales. Teeth sharp, unequal in jaws and palate-bones, none in vomer. Gape of mouth large; lower jaw produced beyond upper, cuspidate. Branchiostegous membrane with seven rays. Two dorsal fins, small, distant.

Sp. *Sphyræna vulgaris* Cuv., *Esox sphyræna* L., Bloch *Ichth.* Pl. 389, Guérin *Iconogr., Poiss.* Pl. 10, fig. 2; in the Mediterranean Sea;—*Sphyræna becuna* Lac., *Poiss.* v. Pl. 9, fig. 3, Bloch *Syst. Ichth.* Tab. 29, fig. 1, from the West Indies, Brasil, &c. Some species also of this genus occur in the Indian Ocean, as *Sphyræna Commersonii* and *Sphyr. jello* Cuv., which with the colonists bear the name of *snoek* (pike). (The snoek of the

Cape-colonists is, as was stated above, a *scomberoïd; Sphyræna* have much more the habitus of pikes, than these.)

Polynemus L. Head scaly, with snout obtuse, prominent. Teeth small, crowded in jaws, vomer and palate-bones. Branchiostegous membrane with seven rays. Two dorsal fins distant. Free fingers below pectoral fins, in various number. Ventral fins little remote from pectoral, adhering to the osseous belt of these. Caudal fin large, deeply bilobed.

Sp. *Polynemus longifilis* CUV., *Polynemus paradiseus* L. (and *Polynem. quinquarius* L., sec. CUV.), SEBA, III. Tab. 27, fig. 2, *Encycl. méth., Poiss.* Pl. 74, figs. 307 and 308, (figures copied from the work of EDWARDS); the *mango*, from the Indian Ocean, the mouths of the Ganges and at Borneo; seven free rays, of which three are longer than the body;—*Polynemus plebejus* BROUSSON. *Ichth.* Tab. VII.;—*Polynemus lineatus* LAC. *Poiss.* V. Pl. 13, fig. 2, SCHLEG. *Faun. Japon., Pisc.*, Tab. IX. fig. 1; in the Indian Ocean, the South Pacific and at Japan, with five free rays at the pectoral fins, which are short and scarcely reach as far as behind the ventral fins. The greatest number of free filaments that have hitherto been observed at the pectoral fins in this genus is fourteen (in *Polyn. multifilis* Mus. L. B., a new species from Borneo), the smallest three.

Haplodactylus CUV., VAL.

Note.—Fish of Chili unknown to me, with four inferior rays of pectoral fins undivided, rays of branchiostegous membrane six, maxillary teeth in several rows, the anterior larger, crenate, with small crowded teeth in the anterior part of vomer, palatine teeth none. Comp. CUV. *et* VAL. *Poiss.* VIII. pp. 476—481, Pl. 242.

B. *Ventral fins jugular.*

Uranoscopus L. Head depressed, rugged, large. Gape of mouth ascending, with upper jaw shorter. Teeth small, crowded in jaws, vomer and palate-bones, sometimes larger, conical, in a single row at the sides of lower jaw. Branchiostegous membrane with six rays. Dorsal fins mostly two, of which the first is small, or the dorsal fin single, long. Pectoral fins ample. Body covered with small scales, rarely scaleless.

Sp. *Uranoscopus scaber* L., BLOCH *Ichth.* Tab. 163, LAC. *Poiss.* II. Pl. XI. fig. 1, CUV. *R. Ani., éd. ill., Poiss.* Pl. 17, fig. 1; the skeleton in ROSENTHAL *Ichthyot.* Taf. 18, fig. 5; in the Mediterranean Sea; also some species from the coasts of India and Japan, and from the South Pacific, as *Uranosc. inermis* CUV. *et* VAL. *Poiss.* III. Pl. 65, CUV. *R. Ani., éd. ill., Poiss.* Pl. 17, fig. 3, with single dorsal fin. In the western hemisphere this genus is represented by a species with two dorsal fins, on the coast of North America, *Uranosc. anoplos* CUV.

Trachinus L. Head compressed, small. Eyes approximate. Gape of mouth ascending obliquely. Teeth thin, crowded in jaws, vomer and palate-bones. Operculum with a very strong spine. Branchiostegous membrane with six rays. Dorsal fins two, contiguous, the first short, the second, like the anal, long; this produced forwards almost to the pectoral fins. Body elongate, compressed, covered with small scales.

Sp. *Trachinus draco* L., BLOCH *Syst. Ichth.* Tab. 10 (named *Trachinus lineatus*), *Skandinav. Fiskar.* Tab. 3, fig. 1; the *weever, la vive, de pieterman;* flesh excellent, seldom 1′ long (mostly only 10″), the second dorsal fin has twenty-nine or thirty rays;—*Trachinus vipera* CUV., *Trach. draco* BL. *Ichth.* Tab. 61, CUV. *R. Ani., éd. ill., Poiss.* Pl. 15, fig. 1; this species is smaller and shorter than the preceding, and has not more than about twenty-four rays in the second dorsal fin. Both species are from the North Sea; the first occurs, with two other species, in the Mediterranean Sea also. That the sharp rays of the first dorsal fin and the spine of the gill-cover are dangerous and even poisonous weapons in these fishes, especially in *Trachinus vipera*, was formerly a general opinion, and beyond doubt they can produce painful wounds; ALLMAN compares a wound which he received from the opercular-spine to the sting of a wasp, *Ann. of Nat. Hist.* VI. 1841, pp. 161—165.

Percis BL., SCHN. Head depressed. Dorsal fins conjoined. No teeth in palate-bones. Remaining characters and habit nearly those of *Trachinus*.

Sp. *Percis maculata* BLOCH, *Syst. Ichth.* Tab. 38;—*Percis cylindrica, Sciæna cylindrica* BLOCH, *Ichth.* Tab. 299, fig. 1;—*Percis cancellata, Labrus tetracanthus* LAC. *Poiss.* II. Pl. 13, fig. 3, GUÉRIN *Iconogr., Poiss.* Pl. 9, fig. 2, &c.—Fishes from the Indian Ocean, the Red and Pacific Seas, which seem to be the representatives of the European genus *Trachinus*.

Note.—Perhaps genus *Trichodon* STELLER is to be placed near *Trachinus*. The ventral fins, however, are thoracic rather than jugular. Dorsal fins two. Body scaleless.

Sp. *Trichodon Stelleri* CUV., VAL. *Poiss.* III. Pl. 57, GUÉRIN *Iconogr., Poiss.* Pl. 7, fig. 3.

Bovichthys CUV., VAL.

Sp. *Bovichthys diacanthus* CUV., VAL. *Poiss.* VIII. Pl. 244; a fish occurring both on the east and west coasts of South America, unknown to me, described formerly by CARMICHAEL under the name of *Callionymus diacanthus*, related to the *Trachini* but distinct from that genus by seven rays of the branchiostegous membrane, by very large eyes, and by habit.

Pinguipes CUV. Head broad, protracted, with fleshy lips. Eyes remote from mouth. Teeth crowded, thin in jaws behind a row of

larger, conical teeth. Teeth in vomer and palate-bones. Branchiostegous membrane with six rays. Pectoral fins rounded, ventrals thick. Dorsal fin single, longitudinal.

Sp. *Pinguipes brasilianus* Cuv., Val. *Poiss.* III. Pl. 63;—*Pinguipes chilensis* Cuv. *R. Ani., éd. ill., Poiss.* Pl. 16, fig. 1.

Percophis Cuv. Head scaly, acuminate, with lower jaw longer than upper. Unequal teeth in jaws, palate-bones and vomer. Branchiostegous membrane with seven rays. Dorsal fins two; anal fin and second dorsal fin long. Body cylindrical, elongate.

Sp. *Percophis brasilianus* Cuv. *et* Val. *Poiss.* III. Pl. 64, Cuv. *R. Ani., éd. ill., Poiss.* Pl. 16, fig. 2.

Aphritis Cuv., Val.

Sp. *Aphritis Urvilii* Cuv., Val. Comp. *Hist. nat. des Poiss.* VIII. Tab. 243, pp. 483—485.

C. *Ventral fins thoracic.*

† *Ventral fins with seven soft rays or more.*

Branchiostegous membrane with eight rays. Eyes large. (*Holocentrini* nob.)

Beryx Cuv. Teeth short, crowded in jaws, vomer and palate-bones. Body high, short. Dorsal fin single, moderate.

Sp. *Beryx decadactylus* Cuv., Guérin *Iconogr., Poiss.* Pl. VIII. fig. 3;—*Beryx lineatus* Cuv., Val. *Poiss.* III. Pl. 60.

Hoplostethus Cuv.

Note.—Is this its place? In the opinion of Cuvier this genus is to be referred to the *Aspidoparei*. Vomer edentulous. Subventral shield of keeled scales. Sp. *Hoplostethus mediterraneus* Cuv. *et* Val. *Poiss.* Pl. 97, bis.

Myripristis Cuv. (with add. of *Holocentrum* ejusd.). Teeth thin, crowded in jaws, vomer and palate-bones. Body high, compressed, covered with large, rough scales. Infraorbital and opercular bones denticulate. Dorsal fins two, contiguous, sometimes conjoined; first long, with strong spines.

Rhynchichthys Cuv. Snout prominent beyond mandibles, acuminate.

Sp. *Rhynchichthys pelamidis* Cuv. *et* Val. *Poiss.* VII. Pl. 208. Here also is to be referred *Holocentrus* Gronovii *Zoophylac.* Tab. IV. fig. 3.

Myripristis Cuv. Snout not produced. Præoperculum denticulate on the margin and on a crest parallel to the margin, destitute of spine.

Sp. *Myripristis Jacobus* Cuv., Desmarest *Dict. class. d'Hist. nat., Atlas,* 1831, Pl. 95, from the West Indies;—other species from the Eastern hemisphere, the Red Sea, the Indian and Sea of Japan, as *Myripristis seychellensis* Cuv., Guérin *Iconogr., Poiss.* Pl. 8, fig. 2, &c.

Holocentrum Artedi, Cuv. Snout not produced. Præoperculum denticulate at the margin and armed with a strong scabrous spine pointing backwards.

Sp. *Holocentrum longipinne* Cuv., *Bodianus pentacanthus, Sciæna rubra* and *Holocentrus sogho* Bloch, *Ichth.* Tab. 232; in the West Indies and on the coast of Brasil. The species are more numerous from the warm regions of the eastern hemisphere, as *Holocentrum orientale* Cuv., Seba *Thes.* III. Tab. 27, fig. 3, from the Indian Ocean, from the Island of Mauritius to the Moluccan Archipelago, *Holocentrum leo* Cuv. *R. Ani., éd. ill., Poiss.* Pl. 14, fig. 1, from the Indian Ocean and Southern Pacific, *Hol. Sammara* Cuv., *Labrus angulosus* Lac. *Poiss.* III. Pl. 22, fig. 1, from the Red Sea and the Indian Ocean, &c.

Fossil species from the division of the *Holocentrini* are more numerous than from the proper *Percæ* and *Serrani*. Besides extinct genera, different species of *Beryx* occur in the chalk formation in England and Germany; of *Holocentrum* and *Myripristis* fossil species are known from the tertiary period, from *Monte Bolca*. Compare Agassiz *Poiss. foss.* IV.

†† *Ventral fins with five soft rays.*

* *Branchiostegous membrane with six rays or fewer.*

Cirrites Commers. Some larger conical teeth in jaws interposed with thin, crowded teeth; teeth in vomer crowded, in palate-bones none. Rays of branchiostegous membrane five or six. Dorsal fin single, longitudinal. Inferior rays of pectoral fins undivided, produced at the point beyond the membrane.

Sp. *Cirrites maculatus* Lac., Cuv. *Labrus marmoratus* Lac. *Poiss.* III. Pl. 5, fig. 3;—*Cirrites arcuatus* Cuv. *R. Ani., éd. ill., Poiss.* Pl. 10, fig. 2, &c. Fishes from the Red Sea, the Indian Sea and Southern Pacific.

Therapon Cuv., nob. (with add. of *Datnia, Pelates, Helotes, Dules* Cuv.). Teeth in jaws crowded, thin, sometimes larger in outer row. Palatine teeth sometimes none. Branchiostegous membrane with six rays. Operculum spinose; præoperculum denticulate. Dorsal fin single, longitudinal; spines strong, the posterior less than the first soft rays.

Sp. *Therapon servus* Cuv., *Holocentrus servus* Bloch, *Ichth.* Tab. 238, fig. 1, Lacep. *Poiss.* III. Pl. 30, fig. 3;—*Therapon puta* Guérin, *Iconogr., Poiss.* Pl. 7, fig. 1;—*Dules auriga* Cuv., Cuv. *et* Val. *Poiss.* III. Pl. 51, species from the Red Sea, the Indian and South Pacific seas.

Nandus Cuv. Teeth thin, short, crowded in jaws, in vomer and palate-bones. Margin of præoperculum and interoperculum finely denticulate; operculum with a spine small or none. Rays of branchiostegous membrane six. Mouth protractile. Eyes large. Body high, compressed. Dorsal fin single, deeply incised in front of soft rays.

Sp. *Nandus marmoratus* Cuv. *et* Val. *Poiss.* VII. Pl. 207, from Bengal. This fish almost agrees with the sub-genus *Dules* of the preceding genus, but differs from it especially in the protractile snout. The genus *Anoplus* Schlegel may be also united with it. Sp. *Nandus anoplus* nob., *Anoplus* Schl. *Faun. Japon., Pisc.* Tab. VIII.

Priacanthus Cuv. Teeth crowded, thin in jaws and palate-bones. Angle of præoperculum produced into a denticulate spine. Entire head and body covered with small scales. Branchiostegous membrane with six rays. Eyes very large. Dorsal fin single, continuous, higher posteriorly. Ventral fins ample.

Sp. *Priacanthus macrophthalmus, Anthias macrophthalmus* Bloch, *Ichth.* Tab. 319, from Brasil;—other species are from the Indian Sea, the Southern Pacific, and especially from the east coast of Asia, as *Priacanthus japonicus* Cuv., Val. *Poiss.* III. Pl. 50, *Priacanthus niphonius* Cuv., Val., *Faun. Jap., Pisc.* Tab. VII. A, &c.

Ichthelis Rafin. Teeth crowded, thin in jaws; palatine-teeth sometimes none. Præoperculum entire or slightly denticulate. Branchiostegous membrane with six rays. Operculum and cheeks scaly. Dorsal fin single. Body compressed, high. Tail thin, short.

Compare Cuvier *et* Valenciennes *Poiss.* VII. pp. 454—469. To this genus belong fresh-water fishes from America, especially from the northern half of that part of the world.

Sub-genus *Pomotis* Cuv. Teeth in palate-bones and tongue none. Præoperculum denticulate. Operculum with a membranous appendage ear-shaped, rounded. Anal fin with three spines, or more rarely with four.

Sp. *Pomotis vulgaris* Cuv., Val. *Poiss.* III. Pl. 49, *R. Ani., 6d. ill., Poiss.* Pl. 10, fig. 3, &c.—*Pomotis elongatus* Holbrook, *Journal of the Acad. of Nat. Sc. of Philadelphia,* Sec. Ser. III. 1855, Pl. 5, fig. 1, and two others.

Sub-genus *Bryttus* Cuv. Teeth in palate-bones few, in tongue none. Præoperculum entire. Operculum without membranous auricle. Anal fin with three spines. (Habit of the preceding sub-genus, from which it is distinguished artificially rather than in reality).

Sub-genus *Centrarchus* Cuv. Teeth in palate-bones and in tongue. Præoperculum entire. Spines of anal fin in most 5—7, more rarely only three.

Sp. *Centrarchus sparoïdes* Cuv., *Labrus sparoïdes* Lac. *Poiss.* iii. Pl. 24, fig. 2, Cuv. *R. Ani., éd. ill., Poiss.* Pl. 10, fig. 1; with nine spinous rays in the anal fin;—*Centrarchus hexacanthus* Cuv. *et* Val. *Poiss.* iii. Pl. 48, &c.

Sillago Cuv. Head conical, with narrow mouth at the apex of snout. Teeth very thin, small, crowded in jaws and vomer. Angle of operculum produced into an acute spine. Branchiostegous membrane with six rays. Two distinct dorsal fins, second long. Body elongate.

Sp. *Sillago acuta* Cuv., *Sciæna malabarica* Bloch, *Syst. Ichth.* Tab. 19; called *Spiering* (*smelt*) by the Dutch at Batavia;—*Sillago erythræa* Cuv., Guérin *Iconogr., Poiss.* Pl. 8, fig. 1, &c.—Fishes from the Red Sea, the Indian and South Pacific Seas, with somewhat of the *habitus* of *Sphyræna*, but with eyes moderate or small; they deviate much from the preceding genera, in whose neighbourhood they are placed solely from the agreement in number of the rays of the branchial membrane.

** *Branchiostegous membrane with seven rays.*

A. *Dorsal fin single.*

a) *Some conical* (*laniary*) *teeth, interposed with the rest, crowded, thin.*

Serranus nob. Teeth small, thin, crowded in jaws, vomer and palate-bones; larger incurved teeth in the anterior part of jaws and at the sides of lower jaw. Præoperculum denticulate. Dorsal fin single, longitudinal.

Mesoprion Cuv. (and *Diacope* ejusd.). Operculum with apex flat, obtuse, not aculeate. Præoperculum often more or less excised above the angle, for receiving the tubercle of interoperculum.

Sp. *Mesoprion octolineatus* Bleeker, *Diacope octolineata* Cuv., *Holocentrus bengalensis* Bloch, *Ichth.* Tab. 246, fig. 2, *Faun. Japon., Pisc.* Tab. vi. fig. 2, from the Red Sea, the Indian and Pacific Oceans;—*Mesoprion uninotatus* Cuv., Val. *Poiss.* ii. Pl. 39, Brasil, St Domingo, &c.;—*Mesoprion aya*

Cuv., *Bodianus aya* Bloch, *Ichth.* Tab. 227, Guérin *Iconogr., Poiss.* Pl. 4, fig. 2, and many other species.

Serranus Cuv. (and *Plectropoma* ejusd.). Operculum spinose.

Sp. *Serranus guttatus* Cuv., *Bodianus guttatus* Bloch, *Ichth.* Tab. 224; this species, as also *Serranus variolosus* Cuv. and some other spotted species from the Moluccan Archipelago, have been from old times commonly known to our sailors by the name of *Jacob Evertsen* (from resemblance to the pimpled and spotty countenance of that admiral).

This sub-genus counts more than a hundred species from different, principally tropical, seas. Some also occur in the Mediterranean Sea; *Serranus anthias* Cuv., *Labrus anthias* L. (*excl. synon.* Catesb.), Bloch *Ichth.* Tab. 315, Cuv. *et* Val. *Poiss.* II. Pl. 31, *Serranus hepatus* Cuv., *Labrus hepatus* L., Bloch *Ichth.* Tab. 235, fig. 1, *Holocentrus siagonotus* La Roche, *Ann. du Mus.* XIII. Pl. 22, fig. 3, (with darker ventral fins and a round dull black spot on the soft part of the dorsal fin; compare on the extensive synonomy of this species Cuv. *Poiss.* II. pp. 231—234); *Serranus scriba* Cuv., *Perca scriba* L., Bloch *Ichth.* Tab. 240 (named *Holoc. fasciatus*), Cuv. *et* Valenc. *Poiss.* II. Pl. 28;—*Serranus cabrilla* Cuv., *Perca cabrilla* L., *Holocentrus virescens* Bloch, *Ichth.* Tab. 233, Cuv. *et* Val. *Poiss.* II. Pl. 29;—*Serranus gigas* Cuv., *Perca gigas* Brunnich and Gm., Cuv. *et* Val. *Poiss.* II. Pl. 33, &c. These fishes have either small or only moderately large scales, a large swimming-bladder and numerous pyloric appendages.

Note.—It is stated above, p. 37, that the sexes in fishes are always distinct. This statement would appear to require modification. See Dufossé *Ann. des Sc. nat.* 4e Série, Tome v. p. 295, Pl. 8, fig. 1—6, 1856. The author contends that hermaphroditism is normal in at least three species of *Serranus*, viz. *Serranus hepatus*, *S. cabrilla* and *S. scriba*, and gives the anatomy and relations of the bisexual organs.

b) *All the maxillary teeth thin, crowded.*

Polyprion Cuv. Head rough. Præoperculum denticulate. Operculum with a rough transverse crest. Cheeks and opercles scaly. Body short.

Sp. *Polyprion cernium* Cuv., Valenciennes in *Mém. du Mus.* XI. 1824, pp. 265—269, Pl. XVII. Bloch *Syst. Ichth.* Tab. 47 (named *Amphiprion australe*), Cuv. *R. Ani., éd. ill., Poiss.* Pl. 9, fig. 1; in the Mediterranean Sea, in the Atlantic Ocean as far as the Cape of Good Hope, and in the Southern Pacific. The skeleton of this fish, so widely distributed, is figured in Rosenthal *Ichthyot.* Taf. XVI. under the name of *Sciæna aquila.*

Acerina Cuv. Head naked, cavernous, with pits subseriate. Præoperculum aculeate.

Sp. *Acerina vulgaris* Cuv., *Perca cernua* L., Bloch *Ichth.* Tab. 53, fig. 2, *Skandinav. Fiskar*, Tab. 1, fig. 2; the *ruffe*, (commonly 6", perhaps never more than 8"), from fresh water in the north of Europe; of an excellent flavour;—*Acerina Schraitzer* Cuv., *Perca Schrætser* L., from the Danube; comp. J. C. Schæffer *Piscium Bavarico-Ratisbonensium Pentas.* Ratisbonæ, 1761, 4to.

Centropristis Cuv. (and *Aulacocephalus* Schleg., *Faun. Jap.*).

Grystes Cuv.

Apsilus Cuv.

Pentaceros Cuv. Body high, trigonal, with belly flattened between the ventral fins remote from each other. A conical tubercle on each side above the eye. Spines of dorsal fin strong.

Sp. *Pentaceros capensis* Cuv. *et* Val. *Poiss.* III. Pl. 43.

Rypticus Cuv. Operculum and præoperculum spinose. Scales very small, concealed under the skin. Dorsal fin long, depressed, with few (3—4) spines; anal fin with only a single very small spine, all the other rays soft.

Sp. *Rypticus saponaceus* Cuv. *et* Val. *Poiss.* III. Pl. 46, a marine fish 9" long, from South America.

B. *Two dorsal fins.*

a) *Some larger conical teeth in jaws interposed, with the rest thin, crowded.*

Etelis Cuv. Dorsal fins contiguous. Margin of præoperculum with very fine denticles.

Sp. *Etelis carbunculus* Cuv. *et* Val. *Poiss.* II. Pl. 18, Guérin *Iconogr., Poiss.* Pl. II. fig. 1; at the island of Mauritius.

Niphon Cuv. Dorsal fins contiguous. Operculum with three sharp spines; præoperculum denticulate with angle produced into a spine running backwards. Cheeks and opercles scaly. Head acuminate. Body elongate.

Sp. *Niphon spinosus* Cuv. *et* Val. *Poiss.* II. Pl. 19, *Faun. Japon., Pisc.* Tab. I.

Lucioperca Cuv. Dorsal fins approximate or contiguous. Margin of præoperculum denticulate, the inferior denticles larger. Body elongate.

Sp. *Lucioperca sandra* Cuv., *Perca lucioperca* L.; Bloch *Ichth.* Tab. 51, Cuv. *et* Val. *Poiss.* II. Pl. 15, Guérin *Iconogr., Poiss.* Pl. 3, fig. 3; a well-flavoured fish from the rivers in the east and north of Europe, which may attain a length of 3′.

Chilodipterus Cuv. (species from genus *Cheilodipterus* Lac., with add. of *Acropoma* Schleg.). Dorsal fins short, distant. Operculum smooth, not aculeate, with margin smooth or with angles plane, obtuse, covered with membrane. Scales large. Eyes large.

Sp. *Chilodipterus octovittatus* Cuv., *Chil. lineatus* Lac. *Poiss.* III. Pl. 31, fig. 1;—*Chilod. arabicus* Cuv. *et* Val. *Poiss.* II. Pl. 23, fig. 1, &c. Fishes from the Red Sea, the Indian Sea and South Pacific.
(*Acropoma* Schl. *Faun. Japon., Pisc.* Tab. 12, figs. 2, 3.)

b) *Maxillary teeth all thin.*

Apogon Lac., *Amia* Gronov. (not L.). Præoperculum margined by a crest, denticulate. Head large, with eyes large. Two dorsal fins remote. Scales large, deciduous.

Sp. *Apogon rex Mullorum* Cuv., *Mullus imberbis* L., Cuvier *Mém. du Mus.* I. Pl. XI. fig. 2, Guérin *Iconogr., Poiss.* Pl. 3, fig. 1; in the Mediterranean Sea. There are also species of this genus in the Red Sea, the Indian Sea, &c.

Pomatomus Risso (not Lac.). Operculum emarginate at the upper part; præoperculum striate. Eyes very large. Dorsal fins distant. Scales large, deciduous.

Sp. *Pomatomus telescopium* Risso, Cuv. *et* Val. *Poiss.* II. Pl. 24, Guérin *Iconogr., Poiss.* Pl. 3, fig. 2, in the Mediterranean Sea, rare.

Ambassis Commers.

Sub-genus *Priopis* Kuhl and V. Hass.? Denticles above the orbits.

Aspro Cuv. Præoperculum finely crenulate; operculum terminated by a spine. Snout obtuse, produced. Dorsal fins distant.

Sp. *Aspro vulgaris* Cuv., *Perca Asper* L., Bloch *Ichth.* Tab. 107, figs. 1, 2, Guérin *Iconogr., Poiss.* Pl. 1, fig. 3;—*Aspro zingel* Cuv., *Perca Zingel* L., in some rivers of middle Europe, the Danube, &c. Compare on these two species the *Pentas* of Schæffer already quoted at *Acerina*.

Grammistes Artedi, Cuv. (species from genus *Gramm.* Bl.). Præoperculum and operculum scaly. Scales very small, hidden

under the skin. Very small cirrus under the symphysis of jaw. Dorsal fins contiguous.

Sp. *Grammistes orientalis* Bloch, Cuv. *et* Val. *Poiss.* II. Pl. 27, Guérin *Iconogr., Poiss.* Pl. 1, fig. 1, from the Indian Ocean, dark brown with three longitudinal stripes running throughout and three shorter white; a small fish.

Centropomus Cuv. (spec. from genus *Centropomus* Lac.).

Huro Cuv.

Diploprion Kuhl and V. Hass. Body high, compressed, covered with small scales. Operculum with four spines, two large; præoperculum denticulate, margined with a rough line. Dorsal fins contiguous.

Sp. *Diploprion bifasciatum* K. and V. H., Cuv. *et* Val. *Poiss.* II. Pl. 21, Guérin *Iconogr., Poiss.* Pl. 2, fig. 2, in the Indian Ocean and at Japan.

Enoplosus Lac. Body compressed, high, with head concave, declivous. Dorsal fins contiguous, high. Præoperculum serrate, with two larger spines at the angle; operculum with two obtuse points. Suborbital bone denticulate.

Sp. *Enoplosus armatus, Chætodon armatus* Shaw, Cuv. *et* Val. *Poiss.* II. Pl. 20, from the South Pacific.

Perca Cuv. (with add. of *Lates* and *Labrax* ejusd., species from genus *Perca* L.). Body elongate. Dorsal fins contiguous. Cheeks scaly. Operculum aculeate; præoperculum denticulate.

Labrax Cuv. (not Pall.). Tongue rough with thin crowded teeth. Cheeks and opercles scaly.

Sp. *Perca labrax* L., *Labrax lupus* Cuv., Bloch *Ichth.* Tab. 202 (named *Sciæna diacantha*), Cuv. *R. Ani., éd. ill., Poiss.* Pl. 7, fig. 1; *sea-perch*, the *basse*, 1′ to 3′ long, in the Mediterranean, and also, though more rare, in the North Sea;—*Labrax lineatus* Cuv., *Perca septentrionalis* Bloch, *Syst. Ichth.* Tab. 20, &c.

Lates Cuv. Tongue smooth. Cheeks and opercles scaly. Bone of humerus serrate above pectoral fins.

Sp. *Perca nilotica* L., *Lates niloticus* Cuv.,—*Lates nobilis* Cuv. *et* Val. *Poiss.* II. Pl. 13; in the Indian Sea, the mouths of the Ganges, &c.

Perca Cuv. Tongue smooth. Opercles naked. Cheeks scaly.

Sp. *Perca fluviatilis* L., Bloch *Ichth.* Tab. 52, *Skandinav. Fiskar*, Tab. 1. fig. 1; the *perch, de baars, der Barsch, la Perche*, &c. In fresh water, nearly throughout Europe and in some parts of Asia; yellowish green, with

dark bands on the back, white below; ventral and anal fins fine red, a black spot at the back part of the first dorsal fin. The perch spawns in the third year and is then about 6″ long; attains a length of 2′, but is rarely taken so large.—There are different species of this sub-genus in North America, which closely resemble the European species, as *Perca serrato-granulata* CUV., GUÉRIN *Iconogr., Poiss.* Pl. 1, fig. 1.

Family XLV. *Osphromenidei* (s. *Labyrinthici*). Third bony piece of the first branchial arch on each side irregularly developed, lamellose, contorted, folded, labyrinthiform, forming cells. Head and opercles scaly; scales mostly large. Ventral fins thoracic. Single dorsal fin long. Branchiostegous membrane with 4—6 rays.

This family consists of fresh-water fishes which are found in the eastern hemisphere, principally between the tropics. They are distinguished by the property of being able to live long out of water, which some of them even leave for a time. The water remains suspended in the cells or cavities of the convoluted, lamellose pharyngeal bones above the gills, so as to keep the latter moist when the fishes are on dry land. Almost all these fishes have a swimming-bladder and only two or three pyloric appendages.

See PETERS *Ueber das Kiemengerüst der Labyrinth-fische,* MUELLER'S *Archiv,* 1853, pp. 427—430, Taf. XIII. fig. 4.

Phalanx I. *Several pungent rays in the anterior part of anal and dorsal fins. Scales ctenoïd.*

a) *Palatine teeth.*

Spirobranchus CUV. Maxillary teeth subulate, thin, crowded. Gape of mouth produced as far as under the eyes. Lateral line interrupted. Operculum with two angles produced posteriorly, not denticulate. Branchiostegous membrane with six rays.

Sp. *Spirobranchus capensis* CUV. *et* VAL. *Poiss.* VII. Pl. 200; in the rivers at the Cape of Good Hope; about 3″ long.

Ctenopoma PETERS. Characters almost of the preceding genus, but operculum, interoperculum and suboperculum with margin denticulate, pectinate.

Sp. *Ctenopoma multispinis,* PETERS in MUELLER'S *Archiv,* 1846, s. 480—482, Taf. X. figs. 10—15, from Mozambique, a small fish like *Spirobranchus.* According to an oral communication of Dr PETERS there are two pyloric appendages, in which respect also this fish agrees with *Spirobranchus.*

b) *Palatine teeth none. Gape of mouth small.*

Osphromenus COMMERS. (with addit. of *Macropodus* LAC. and *Trichopus* ejusd.). Body compressed. Lateral line continuous, sometimes indistinct. First soft ray of ventral fins undivided, produced into a long filament.

Osphromenus COMMERS., CUV. (and *Trichopus* LAC., CUV.). Caudal fin moderate, rounded, or sublunate, with lobes obtuse.

Sp. *Osphromenus olfax* COMMERS., LAC., *Poiss.* III. Pl. 3, figs. 2, 3, CUV. *et* VAL. *Poiss.* VII. Pl. 198, CUV. *R. Ani., éd. ill., Poiss.* Pl. 73, fig. 1; the *gourami;* one of the best flavoured fresh-water fishes, which may attain a length of 20″, from the East. Indies, at the Sunda Islands, now also transferred to Cayenne. The younger individuals have brown bands and a black spot (*Osphromenus notatus* KUHL and V. H.).

Trichopus trichopterus LAC., *Labrus trichopterus* PALL., GMEL., CUV. *et* VAL. *Poiss.* VII. Pl. 199, Java, Sumatra, Borneo; only 4″ long; the dorsal fin is short, and terminates much in front of the caudal fin. According to BLEEKER this fish is subject to great variations in colour and in the number of the fin-rays.

Macropodus LAC. Caudal fin large, forked; soft rays of dorsal and anal fins, as also the rays of caudal fin, elongated into filaments.

Sp. *Macropodus viridi-auratus* LAC., CUV. *R. Ani., éd. ill., Poiss.* Pl. 74, fig. 2; China, Cochin-China.

Tilapia SMITH. Head naked.

Sp. *Tilapia Sparmanni* SMITH; South Africa.

Betta BLEEKER.

Sp. *Betta trifasciata* BLEEKER, *Verh. van het Batav. Genootschap.* XXIII. 1850.

Polyacanthus KUHL and V. HASS. Body compressed. Mouth ascending obliquely, small. Lateral line interrupted. Dorsal and anal fins very long, with several pungent rays.

Colisa CUV. Ventral fins with single soft ray, produced into a very long filament, after a very short spine, scarcely distinguishable. Rays of branchiostegous membrane five?

Sp. *Polyacanthus colisa, Colisa vulgaris* CUV. *et* VAL. *Poiss.* VII. Pl. 196, GUÉRIN *Iconogr., Poiss.* Pl. 36, fig. 2, &c. Different species from the continent of India, from the Ganges, &c.

Polyacanthus KUHL and V. HASS., CUV. Ventral fins with six rays. Branchiostegous membrane with six rays.

Sp. *Polyacanthus Hasselti* CUV. *et* VAL. *Poiss.* VII. Pl. 195, CUV. *R. Ani., éd. ill., Poiss.* Pl. 72, fig. 1; 6″ long, on the Island of Java.

Helostoma KUHL and V. HASS. Mouth small, with fleshy lips. Teeth very thin, adhering to lips not jaws. Dorsal and anal fins placed in a furrow surrounded by scales. (Other characters and habit nearly those of *Polyacanthus*.)

Sp. *Helostoma Temminckii* CUV. *et* VAL. *Poiss.* VII. Pl. 194; at Java and Borneo.

Anabas CUV. Body oblong, round, posteriorly subcompressed. Head gibbous, flattened between the eyes, which are remote from each other, marked with pores in rows. Margin of operculum and suboperculum denticulate. Lateral line interrupted. Dorsal and anal fins received in a longitudinal furrow surrounded by scales.

Sp. *Anabas scandens* CUV., *Anthias testudineus* BLOCH, *Ichth.* Tab. 322, BUCHANAN *Fishes of the Ganges*, Pl. 13, fig. 38, GUÉRIN *Iconogr., Poiss.* Pl. 36, fig. 1; fig. of the skeleton in ROSENTHAL *Ichthyot.* Taf. XIV. fig. 2, of the gills, figs. 3, 4; this fish is met with both in the rivers of the continent of the East Indies and on different islands of the Indian Archipelago; it attains a length of 6—7″. According to DALDORFF (*Linnean Transact.* III. p. 62) and JOHN (BLOCH *Syst. Ichth.* p. 205) this species sometimes climbs up the palms on the bank and stays in the rain-water collected between the leaves. BUCHANAN did not observe this peculiarity, and casts doubts upon it, although he states that the fish can remain alive five or six days out of water, l. l. p. 29.

Phalanx II. *All the rays of fins soft, articulate, except the first ray of ventral fins simple. Scales cycloïd.*

Ophicephalus BLOCH. Body elongate, round, posteriorly subcompressed. Head flat, covered with polygonal scutes. Gape of mouth ample, produced below the eyes. Anterior orifices of nostrils with a very short tubule, placed at the lips. Teeth small, crowded in jaws, vomer and palate-bones, sometimes with a few larger interposed. Branchiostegous membrane with five rays. Lateral line continuous.

Snake-head, *Koravé* (Pondicherry), *Varal* (Tranquebar), *Ikan Gabus* (with the Malays and Javanese). These fishes ought properly to belong to the *Malacopterygians*, but they agree too nearly in the structure of the laminiform gill-appendages and in other particulars with the other genera of this family, to allow of their being placed elsewhere.

Sp. *Ophicephalus punctatus* BLOCH, *Ichth.* Tab. 358 (*Ophiocephalus lata* BUCHANAN, *Fish. of the Ganges*, Pl. 34, fig. 18);—*Ophic. marginatus* CUV., *Ophic. gachua* BUCHANAN, l. l. Pl. 21, fig. 21, Hindostan, Java; *Ophic. striatus* BLOCH, *Ichth.* Tab. 359, *Syst. Ichth.* Tab. 52, CUV. *R. Ani., éd. ill., Poiss.* Pl. 75, fig. 2, Hindostan, Java, Celebes, &c.

C. Muscular bulb at the base of arterial trunk with two spiral valves or longitudinal folds. Respiration at once pulmonary and branchial.

See above, pp. 60, 75.

SECTION V. *Protopteri* (*Diplopnoi*).

ORDER XI. *Protopteri.*

Dorsal chord (Notochord OWEN) in place of bodies of vertebræ. Skeleton partly cartilaginous, partly osseous. Pectoral and ventral fins resembling subulate, flexible cirri. Body covered with cycloïd scales invested with epidermis.

Family XLVI. *Sirenoïdei* s. *Pneumoïchthyi.*

We here subjoin to the class of fishes a family of which the discovery is very recent, and which has caused no small perplexity to zoologists, inasmuch as it appeared doubtful whether it was to be referred to this class or to that of reptiles. The first species known was from Brasil, and was described as a reptile (1837); shortly after a similar animal, but of less size and shorter body, was discovered in Africa, and was regarded by OWEN as a fish.

Compare *Annalen des Wiener Museums der Naturgeschichte*, 1837, II. Bd. s. 165—170, Tab. X. (Lepidosiren paradoxa, *eine neue Gattung aus der Familie der Fischähnlichen Reptilien*, VON J. NATTERER).

TH. L. W. BISCHOFF, Lepidosiren paradoxa, *anatomisch untersucht und beschrieben.* Mit 7 Steindrucktafeln. Leipzig, 1840, 4to.

Lepidosiren paradoxa. *Monographie von* DR J. HYRTL. Mit fünf Kupfertafeln. Prag. 1845, 4to.

R. OWEN *Description of the* Lepidosiren annectens, *Transactions of the Linnæan Society*, Vol. XVII. 1840, pp. 327—361, Tab. 23—27.

W. PETERS *Ueber einen dem* Lepidosiren annectens *verwandten Fisch von Quellimane*, MUELLER'S *Archiv*, 1845, s. 1—14, Taf. I—III.

Lepidosiren NATTERER. Two small teeth, conical, moveable in intermaxillary bone; two large teeth, folded longitudinally in the margin of each jaw, cohering with jaw. Body round, posteriorly compressed, surrounded by dorsal and anal fin confluent at the acuminate extremity. Branchial aperture vertical in front of pectoral cirrus or fin. Ventral fins abdominal, remote, resembling the anterior but nearer to the lower surface of body.

Sp. *Lepidosiren paradoxa* NATTERER, l. l.; from Brasil, in morasses by the river Amazon; this species becomes more than 3′ long. *Lepidosiren annectens* OWEN, from Africa, first discovered in the Gambia, afterwards

found also on the east coast of South Africa in the morasses of Quellimane. PETERS saw specimens 2′ long; from the Gambia none are known that were much longer than 1′. External gill-leaflets above the gill-aperture occur in *Lepidosiren annectens* from the Gambia (at least sometimes) as well as in the fish from Mozambique. In one specimen I saw two on the left side whilst on the right side they were wanting; PETERS gives three on each side to the fish observed by him. The inferior margin of the awl-shaped fins has a membranous border with fine rays, which OWEN has not noticed, but which in the specimen from the Gambia observed by me was not absent, although it was much smaller than that recorded by PETERS in the fish from Mozambique. In *Lepidosiren paradoxa*, which I know only from figures, the border appears to be absent; external gills were not observed either by BISCHOFF or by HYRTL.

In the internal structure of *Lepidosiren paradoxa* and *Lepidosiren annectens* there is some difference, but considering the great agreement of these two species I think it unseasonable to adopt a separate genus for each of them. Perhaps also much of the difference may disappear on closer comparative investigation.

When the morasses or brooks, in which these animals live, have lost their water in the dry season, these fishes keep at the depth of some feet underground. They live on vegetable matters, as the Brasilians report, and as indeed is apparent from microscopic investigation of the remains of the food in the intestinal canal.

The branchial arches are cartilaginous strips without connexion with the hyoïd bone; the African species has six on each side, the American five. These arches however do not all bear gills; only on two arches (on the third and fourth, or in the African species on the fourth and fifth) is there a double row of gill-leaflets present. On each side there are three or four arterial arches which arise from the *bulbus arteriosus;* branches alone of these go to the gills. Perhaps at an earlier period of life the gills are more developed and are present on all the branchial arches, as HYRTL surmises; but in the adult animal the change from venous to arterial blood is chiefly effected in the swimming-bladder; this forms two large cellular sacs under the back, behind the peritoneum, and has in front a common part which bends round the œsophagus below and opens with a short canal on the abdominal surface, not in the middle, but somewhat towards the right side, by a fissure (glottis) into the œsophagus. The vein of the swimming-bladder, the pulmonary vein, enters the auricle of the heart separately, at a distance from the *venæ cavæ*. In *Lepidosiren paradoxa* the auricle is double; the partition however is not a continuous membrane, but a retiform tissue everywhere perforated.

The urinary bladder is situated and opens behind the rectum. This is a piscine conformation. The stomach is little wider than the œsophagus, which passes into it without any definite boundary. At the pylorus there is an annular membranous valve near which the gall-duct opens. The intestinal canal has a spiral valve (as in many *Plagiostomes*), which terminates at some distance from the extremity. The anus is not situated in the middle, but sometimes more to the right (commonly so in *Lepidosiren annectens*), sometimes more to the left.

CLASS XV.

REPTILES (*REPTILIA*)[1].

THE Reptiles are vertebrate animals, mostly oviparous and cold-blooded[2], that breathe by lungs. Some breathe at first by gills, which afterwards disappear, when the lungs have been developed; whilst in a few, during the whole life, there are both gills and lungs.

The spinal column is in this class of very various length, and by this is already indicated the much greater diversity of form by

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[1] On this class may be consulted:

LACEP. *Quadrup. ovip. et serp.*, LACEPÈDE, *Histoire naturelle des Quadrupèdes ovipares et des serpens.* Paris, 1789, 2 Vol. 4to, with many (mostly very defective) figures.

J. E. SCHNEIDER *Historiæ Amphibiorum natur. et literariæ Fasc.* II. Jenæ, 1799, 1801, 8vo, with plates.

DAUD. *Rept.* F. M. DAUDIN, *Histoire natur. générale et particulière des Reptiles.* Paris, An. X. XI. (1802, 1803) VIII. Tom. 8vo, with plates.

MERREM *Beitr.* B. MERREM *Beiträge zur Gesch. der Amphibien.* Duisburg, Leipzig und Essen, 1790—1821. 3 Heft, 4to, with coloured plates.

DUMÉR. *et* BIBRON *Erpétol.* A. M. C. DUMÉRIL *et* G. BIBRON, *Erpétologie générale ou Hist. nat. complète des Reptiles*, IX. Vol. 8vo, Paris, 1834—1854, avec Atlas de 108 Pl.

As systematic works we may add the following:

J. N. LAURENTI *Specimen medicum exhibens synopsin Reptilium.* Cum tab. æn. Viennæ, 1768, 8vo,—A. BRONGNIART, *Essai d'une classification des Reptiles.* Paris, 1805, avec 2 Pl. 4to,—B. MERREM *Tentamen systematis Amphibiorum.* Marburgi, 1820, 8vo,—L. J. FITZINGER *Neue Classification der Reptilien.* Wien, 1826, 4to, and by the same, *Systema Reptilium, Fasciculus primus. Amblyglossæ.* Vindobonæ, 1843, 8vo,—J. WAGLER *Naturliches System der Amphibien.* München, Stuttgart und Tübingen, 1830, 8vo.

As collections of figures we may cite:

H. SCHLEGEL *Abbildungen neuer oder unvollständig bekannter Amphibien.* Dusseldorf, 1837—1844 (50 col. plates in large 4to, with explanatory text in 8vo); many *Reptilia* are figured in the first and second parts of the great work of SEBA, *Locupletissimi Rerum naturalium Thesauri accurata descriptio et iconib. artif. expressio*, Amstelod. 1734—1765, IV. Vol. folio; also the *Abbildungen zur Naturgeschichte Brasiliens.* by Prince MAX of Wied (15 Liefer. Weimar, 1822—1831, folio) contain principally species of Reptiles (only a few Mammals and Birds). Of the German species of Reptiles small but generally good figures are to be found in STURM *Deutschlands Fauna*, 3te Abth. Die Amphibien 6 Hefte. 1797—1828, 12mo.

[2] On the temperature of Reptiles see A. DUMÉRIL *Rech. experimentales sur la temperature des Reptiles, Ann. des Sc. nat.*, 3ième Série, XVII. 1852, *Zool.* p. 522.

which this class is distinguished from others, and particularly from that of birds and mammals. For whilst in the tail-less batrachians, only nine or eight vertebræ are counted, some serpents have full three hundred. In most reptiles the body of the vertebræ is convex on the posterior surface, concave on the anterior; in serpents especially these parts are to be regarded as true articular heads and articular cavities, whilst in them the vertebral column has great mobility. The inferior spinous processes, which exist in most of the vertebræ of the trunk in serpents, are curiously modified in *Rachiodon* (*Tropidonotus scaber*): here these processes of thirty or thirty-one vertebræ following the second are bent forward, and the seven or eight posterior of them penetrate through the œsophagus, and have enamelled point-like teeth[1].

The vertebræ of the batrachians have long transverse processes; ribs are wanting or are represented on some vertebræ merely by cartilaginous excrescences at the extremity of the transverse process. In the serpents the ribs are both very numerous and very moveable; where they cease, the tail begins; here the caudal vertebræ may be distinguished from the other vertebræ of the trunk, whilst all distinction of cervical, dorsal and lumbar vertebræ fails. In the lizards such a distinction prevails, although the lumbar vertebræ, and often the cervical vertebræ also, are provided with smaller ribs or rudiments of ribs. In the Chelonians, the ribs, in conjunction with the spinous processes of the vertebræ, changed into broad plates, form the dorsal shield (*carapace*), which covers the body of these animals above. The ventral shield (*plastron*), on the other hand, is formed by the large sternum, consisting of nine pieces. In part, however, the dermal skeleton also enters into the formation of these shields, by the marginal pieces on each side of the dorsal shield, as well as by the unpaired dorsal plates, which do not lie upon vertebral arches; and probably also by coalition with the plate-like spinous processes of the vertebræ, and by amplification of the ribs and of the sternal pieces[2].

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[1] JOURDAN *Institut.* 1834, No. 60, 61, DUM. *et* BIBRON *Erpét.* VI. p. 160 *et suiv.* VII. p. 491 *et suiv.*, STANNIUS *Handbuch der Zootomie*, 2te Aufl., 2tes Heft, s. 20.

[2] After CARUS had expressed the opinion, that there is also an external skeleton, a dermal skeleton, in the shield of tortoises which has coalesced with the neural skeleton, the conception was more fully developed and defended by Dr W. PETERS,

In the true serpents the sternum and the belt of the clavicles are both wanting. In the frogs the sternum is as it were superseded by the two pairs of clavicles, which meet one another in the mid-plane, and is almost limited to a triangular piece in front of these and a stiliform piece behind them (the *episternale* and *xiphisternale*), to both of which a thin round cartilaginous disc is attached. In the sternum of the lizards a rhomboidal principal piece is seen, and in front of it frequently a bone that runs out into two transverse arms and a stiliform part behind, that extends over the rhomboïdal disc. Other small bony pieces may range themselves backwards, to which, as well as to the central rhomboïd piece, the ribs are attached at the sides.

There are usually, as in birds, two clavicles on each side. The anterior clavicles, which correspond to the *furcula* of birds, are thin, and lie towards the anterior margin of the sternum; the posterior clavicles are broader (*ossa coracoïdea*) and run obliquely to the anterior side of the rhomboid piece of the sternum. If only one pair of clavicles are present (*crocodilus*, *chamæleon*), it is the anterior pair, those which correspond to the clavicles of mammals, that are wanting.

The pelvis of the frogs consists of two long iliac bones (*ossa ilea*), which are fastened to strong and broad processes of the sacral vertebra, and meet behind at an acute angle the long triangular compressed caudal vertebra lying between them. At the

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Observationes ad Anatomiam Cheloniorum. Berolini, 1838, 4to, MUELLER'S *Archiv*, 1839, s. 290—295. H. RATHKE however declared himself against this view, and only regarded the marginal pieces of the dorsal shield, together with the whole thoracic shield, as dermal skeleton; *Ueber die Entwickelung der Schildkröten.* Braunschweig, 1848. This controversy was afterwards discussed by R. OWEN, *Phil. Transactions* for 1849, Part I. pp. 151—171, Pl. 13, whose conclusions respecting it have principally formed the basis of the view we have presented. [The nine sternal pieces were named by GEOFFROY ST. HILAIRE as follows, a middle piece the entosternal, with 4 pairs of pieces, viz. 2 episternals in front of entosternal, 2 hyosternals, 2 hyposternals, 2 xiphisternals, one on each side from before backwards. "The entosternal, and perhaps the episternals, are the sole parts of the plastron which can be referred to the sternum ... the parial or lateral parts, more especially the hyosternals and hyposternals, are the true hæmapophyses," (sternal and abdominal ribs) "but in connation with dermal bony plates to which their characteristic breadth, especially in the land and fresh-water chelonians, is chiefly due." OWEN l. l. p. 166.] On the sternum of Saurians see H. RATHKE *Ueber den Bau und die Entwickelung des Brustbeins der Saurier.* Königsberg, 1853, 4to.

union of the iliac bones, the ischiadic and pubic bones are placed, forming together a round, laterally compressed disc. In the Saurians the pelvis is usually more perfectly formed; the three bones, which compose it on each side, meet each other at the articular cavity for the thigh-bone, and the ischiadic bones unite behind the junction of the pubic bones, whilst between these two unions a very large aperture remains. Often the resemblance is here very striking to the osseous belt formed by the two clavicles and the scapula.

In the Ophidians no limbs are present, except only in the genus *Chirotes*, in other respects so similar to *Amphisbæna*, where short anterior limbs occur, and except the traces of hind limbs which are found hidden beneath the skin in many serpents, either wholly, or with the exception of the conical nail-joint. The rest of the reptiles have, on the other hand, very commonly four limbs, mostly provided with five fingers, and on the whole composed upon the same fundamental plan as in the mammals. The upper-arm bone and the thigh-bone are however directed outwards, whence the elbow and knee-joints are at a distance from the trunk. The bones of the carpus are more numerous than those of the tarsus. In the anterior extremities of the frogs, the place of radius and ulna, as in the hinder extremities that of tibia and fibula, is occupied by a single bone; yet even externally, but more obviously when it is sawn across, it may be seen that two bones which have coalesced compose that single bone.

On the bones of the head it is difficult to say anything general. The occipital bone in batrachians consists principally or exclusively of two lateral pieces, which meet above and below, and so surround the occipital hole. Each of these lateral occipital bones has an articular tubercle, which is connected with the first vertebra. In the scaly reptiles, the serpents, lizards and tortoises, the articular tubercle serving for connexion with the atlas is, on the contrary, placed in the middle under the large occipital foramen, as it is in birds, and is principally formed by the basal piece of the occipital bone, and only in part by the lateral occipitals, which close upon it. A large part of the cranium in the frogs continues membranous or cartilaginous. The base of the cranium is formed almost exclusively of the flat body of the sphenoïd. The other cranial bones are very aberrant and various; they are, as in fishes, more numerous than in mammals. The temporal bone is always

composed of several separate bony pieces, of which one serves for articulation with the lower jaw (the quadrate bone). In the batrachians the jugal bone also contributes to form the articular tubercle, which is received by the articular surface of the lower jaw. The cranium is always small in comparison with the rest of the bony head, so that in some (the frog, ex. gr. and the chameleon) the orbital cavity is larger than the space in which the brain is contained.

In forming the upper jaw the intermaxillary bones are of much less importance than in the class of fishes; here they constitute only the middle part of the upper margin of the oral aperture. In the serpents and in most of the saurians they coalesce to form an unpaired bone. The under jaw constantly consists of a greater number of pieces than in mammals. The articular piece, which is in connexion with the quadrate bone, always continues distinct from the anterior part, in which the teeth are fixed. The two halves of the lower jaw are united with one another in the middle without suture in the chelonians, but continue distinct from each other in the rest.

Most reptiles have teeth, which, however, in all the chelonians and in *Pipa* amongst the batrachians are wanting. In the first of these the two jaws are usually covered with a fibrous horny tissue. The teeth serve, not so much for dividing or chewing, as for holding fast the food; their form too does not differ, as in the mammals and many fishes, in the different parts of the oral cavity, and the distinction as incisive, cuspidate and molar teeth, falls to the ground. In most saurians the teeth are only in a single row in both jaws; in some there are also teeth in the palate. In the serpents there is a row of teeth on each side in the palate, and usually a row in the two jaws. On the poison-teeth of serpents we shall treat afterwards in the systematic arrangement of this class. In the batrachians teeth are usually found in the palate (in the vomer), and also a row of small, thin, conical or card-shaped teeth in the upper jaw, which however are wanting in most toads. The salamanders have such teeth in both jaws.

The tongue sometimes serves for the capture of food. The batrachians catch small animals with it; here the tongue is attached forwards to the margin of the lower jaw and with the free part thrown back; this part can reverse itself and be projected

from the mouth; the adhesive mucus, with which the surface of the tongue is covered, causes the little worms and insects that are touched by it to adhere. A cylindrical tongue, capable of great extension, which is shot from the mouth with much rapidity, is the weapon by which the chameleon overpowers his prey. In most of the saurians however, and in the serpents, the tongue does not serve for seizing the food, but is rather an organ of feeling or tact, of which these animals avail themselves almost as insects do of their feelers and antennæ.

Salivary glands, which are missing in fishes, are here also often wanting, as in the batrachians, or are only slightly developed. In many lacertine animals and in serpents small glands are situated along the jaws, or in the lips, which give out the fluid secreted by them through numerous apertures. Often also there is a sublingual salivary gland, in serpents and lizards, as well as in land and fresh-water tortoises[1]. The poison-glands of serpents we shall describe subsequently.

The œsophagus is longer than in fishes and more clearly distinguishable from the stomach[2]. In the salamanders, however, the œsophagus passes insensibly into the elongated stomach, which becomes narrower near the pylorus, and forms a fold before it terminates in the duodenum. The stomach of serpents is only slightly wider than the rest of the intestinal tube; it is without curvature, and has thicker walls than the œsophagus; its inner surface presents longitudinal folds. These occur also in the stomach of tortoises, where also are seen numbers of small apertures of glands that lie in its walls. The œsophagus of turtles is beset on the inside with large conical papillæ placed close together, which have a horny envelope (*epithelium*), and whose points are turned backwards; in the rest of the tortoises they are wanting. In the crocodiles the stomach is round and the muscular coat thick; it has a great resemblance to the stomach of birds[3].

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[1] See this gland in the European fresh-water tortoise, where it has many ducts that perforate the tongue, figured by L. H. Bojanus in his eminent *Anatome Testudinis Europeæ*, 1819—1821, folio. Tab. 26, figs. 140, 141 H.

[2] On the deglutition of reptiles compare Dugès *Ann. des Sciences nat.* XII. 1827, pp. 337—395, Pl. 48.

[3] The stomach of *Crocodilus acutus* is very beautifully figured in the *Catalogue of the physiological series of comparative Anatomy in the Museum of the College of Surgeons.* London, 1833, I. Pl. 9, p. 266.

The length of the intestinal tube in most reptiles is only twice that of the body; in the lizards it is about as long as the body, if the tail, which is usually very long, be included; sometimes the length of the body, estimated in this way, surpasses that of the intestinal canal[1]. The larvæ of frogs and the land-tortoises, which live on vegetable food, have the longest intestinal canal; in these its length surpasses that of the body three, nay even six times or more.

The boundary between the small and large intestine is often indicated in reptiles by an annular membranous valve, or by a cœcal tube at the origin of the large intestine. This cœcal tube, which is almost never found in fishes, is wanting also in various reptiles, in most batrachians, in many serpents, in the crocodile, the turtles, &c., but still is present in many, especially in most of the lacertine animals[2].

The reptiles have a *cloaca* or cavity in which are found the termination of the rectum, the aperture of the bladder, and those of the ureters and oviducts or seminal ducts. Sometimes this cloaca is to be regarded as a dilatation of the rectum. The *anus* or the external opening of the *cloaca* is in the frogs and toads situated behind on the back, in the tortoises sometimes under the point of the tail. The opening is round or oval in the frogs and tortoises, but in the serpents and most of the saurians is formed by a transverse fissure under the base of the tail.

The liver is large in reptiles; often it is not divided into lobes, but only incised at the margin. In the crocodiles, however, in the frogs and tortoises, the liver consists of two lateral portions, sometimes quite distinct from each other and connected solely by a duplication of the peritoneum, yet usually united by two or three transverse strips. The liver receives a large quantity of venous blood. In almost all (and the exceptions are not always constant) there is a gall-bladder, which, however, is of less size than is common in birds and mammals. Sometimes it lies hidden in the

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[1] Comp. CUVIER *Leç. d'Anat. comp.* III. p. 457, 2nde éd. IV. 2, p. 308.

[2] Comp. TIEDEMANN *Ueber den Blinddarm der Amphibien*, in MECKEL'S *Archiv f. d. Physiol.* III. s. 368—374, and generally on the intestinal canal in this class, a paper of MECKEL himself in the same vol. s. 199—232, with figures. On the intestinal tube of serpents, see DUVERNOY *Ann. des Sc. nat.* XXX. pp. 128—155.

liver, but mostly free and close to the concave surface of the liver; in some serpents only, where the liver lies very forward, the gall-bladder is found at a distance from it, and placed more backward. Sometimes the cystic duct arises from the hepatic duct; sometimes the hepatic ducts pass immediately into the gall-bladder (*ductus hepatico-cystici*). Mostly the cystic duct unites with the hepatic duct to form a common *ductus choledochus*[1].

The *pancreas*, constantly present in reptiles, is often large, but varies in form in the different genera. The number also of the ducts differs; usually there is only one; in the Nilotic crocodile there are two, which penetrate the intestinal canal below or behind the gall-ducts; in the European fresh-water tortoise there are, according to BOJANUS, two. In some serpents also the ducts are two or even more; in *Python* the *pancreas* is divided into many distinct lobes, each with its separate duct; these ducts fall, like veins, into larger trunks which penetrate the intestinal canal[2].

The spleen in this class is always present, generally small, and often situated close to the stomach, although it varies in this respect as also in that of its size. In the serpents it is mostly situated in front of the *pancreas* and in close connexion with it[3].

Productions or duplicatures of the peritoneum, by which the intestinal canal is supported and attached, and which bear the name of *mesentery*, are always present, though in various degrees of development. The productions of the peritoneum, on the contrary, which hang from the stomach or the intestinal canal, the *omenta*, are wanting, although two appendages of the peritoneum

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[1] In some crocodiles, as *Alligator sclerops*, the cystic duct continues distinct from the hepatic duct, and the two open into the duodenum by separate apertures; see W. VROLIK in the *Bijdragen tot de natuurkundige Wetenschappen*, I. blz. 167, Pl. III, fig. 1.

[2] DUVERNOY, *Ann. des Sc. nat.* XXX. p. 123.

[3] According to MECKEL (*System der vergl. Anat.* IV. s. 371) the spleen is wanting in serpents, a statement confuted by DUVERNOY l. l. pp. 113—121. According to ARISTOTELES, BARTHOLINUS and PERRAULT the chameleon should have no spleen. Some years ago this was also asserted by G. R. TREVIRANUS (*Die Erscheinungen und Gesetze des organischen Lebens*, I. 1831, s. 345). He however himself described a small dark body, apparently the same with that which W. VROLIK considers to be the spleen (*Opmerkingen over den Chameleon*, blz. 57), and which has also been observed by myself. It lies under and behind the stomach between the laminæ of the mesentery.

which are loaded with fat, in many saurians, and membranous filaments, also containing fat, in the serpents, somewhat resemble them.

The lymphatics seem in reptiles to be destitute of valves, except at the place where they open into the veins. They are highly developed, form numerous plexuses, and here and there sacciform expansions, but no lymphatic glands. The large blood-vessels are often surrounded by wide lymphatics or by lymphatic plexuses, as by a sheath. There are two thoracic ducts, or the single thoracic duct divides anteriorly into two branches, which deliver the chyle, mixed with the lymph, into the subclavian veins, or anterior venous stems. In different reptiles pulsating lymphatic spaces have been discovered, which are in connexion with veins, and force the lymph into them. In the frog, and in many other reptiles, two such lymphatic hearts are situated on the back, behind the joint of the thigh-bone, immediately beneath the skin; they empty their lymph into a branch of the *ischiadic vein*. These pulsating cavities occur also in lizards and tortoises, and in serpents they lie under the vertebræ in front of the commencement of the tail. In the frog, besides these lymphatic hearts, there are two other anterior, which lie under the scapula on the transverse processes of the third vertebra[1].

In most reptiles the two ventricles of the heart are united to form a single cavity, or are only imperfectly separate. Invariably a portion only of the venous blood is distributed to the lungs, whilst another portion, mixed with arterial blood, is sent to the different parts of the body. The heart is thus at once both arterial and venous, and not, as in fishes, solely venous; but the arterial part is not, or not so completely, distinct from the venous, as in the birds and mammals.

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[1] Compare the splendid work of PANIZZA, *Sopra il Sistema linfatico dei Rettili Ricerche zootomiche*, Pavia, 1833, folio. The work of RUSCONI on the same subject is known to me only from extracts (see ex. gr. DUVERNOY *Ann. des Sc. nat.* 3ième Série, 1847, VII. *Zoologie*, pp. 337—381). The pulsating lymphatic hearts were first discovered in the frog by J. MUELLER, and almost simultaneously by PANIZZA, in this and other reptiles; see also E. WEBER on similar lymphatic hearts in *Python*, MUELLER'S *Archiv*, II. 1835, s. 535—547, Taf. 13, figs. 5—10. They were last demonstrated in tortoises, also by MUELLER; see *Abh. der Berl. Akad. der Wissenschaften, Physik. Klasse*, 1839, s. 31—33, with fig.

Formerly it was supposed that the batrachians have only a single auricle of the heart. Later investigations, however, first by J. DAVY, and afterwards the nearly contemporaneous observations of other anatomists, have proved that the auricle of frogs is divided internally by a partition, and thus is really double[1]. In the salamanders also and *Proteïdæ* there is a similar partition, which, however, in some is incomplete or perforate[2]. The pulmonary veins empty themselves in all these animals not, as earlier writers on comparative anatomy state (who usually gave merely an extract from the description of the circulation in the frog offered by Swammerdam more than a century and a half previously), into the anterior cavæ, but into the left auricle either separately and close together, or (in frogs) after they have formed a short common stem. The ventricle in these naked reptiles is single. It has a muscular appendage (*bulbus arteriosus*) at the origin of the arteries, which corresponds to the appendage of the heart in cartilaginous fishes, and in the Proteïds, as well as in these, is provided with different rows of valves[3]. In the serpents the ventricle is of a conical form and divided by an imperfect muscular septum into two chambers. From one of the cavities the pulmonary artery arises, and from the other, or uppermost, towards the right side, two arterial stems. The one of these large arterial stems, which runs forward and to the right, gives off the arteries of the anterior part of the body (two stems, the *cephalic artery* or *common carotid*, and the *arteria collaris*, which CUVIER names *vertebral artery*). This artery afterwards bends downwards to the right and gives off some other branches, when it unites with the second large artery, which on the left side of the heart, after having formed an arch, runs backwards, and conveys blood to the parts only which are situated behind the heart. Since the serpents have no limbs, they have no subclavian arteries as distinct stems. Two descending *venæ*

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[1] DAVY made the discovery in 1825, in toads; see *Edinburgh new Philos. Journal*, Vol. IX. pp. 160, 161. In 1832 two independent observers, MARTIN SAINT-ANGE and M. J. WEBER, arrived at the same result. See M. J. WEBER *Beiträge zur Anat. und Physiol.* I. Bonn, 1832, 4to, s. 1—5, Tab. I. figs. 1—6.

[2] OWEN, *Transact. of the Zool. Soc.* 1835, I. pp. 213—220, Pl. 31. According to HYRTL, the septum in *Proteus* is incomplete.

[3] See the figure of the heart of *Menopoma* in the *Catalogue of the physiol. series of comp. Anat. in the Museum of the Coll. of Surgeons*, II. 1834, Pl. XXIII. fig. 2.

cavæ, which here, in the absence of subclavian veins, are formed by the jugular veins, and one posterior or ascending *vena cava*, return in the serpents the venous blood to the heart[1].

In the lizards and tortoises the heart is formed of two auricles, usually completely separate from each other by a septum, and two ventricles only incompletely separate from each other, with the exception of the crocodiles. However in the tortoises, according to CALDESI and others, the arterial blood is distinguished by a bright red colour from the darker venous blood[2]. In the tortoises the heart is broader than long, and has very spacious auricles and thick muscular walls. From the heart arise two arterial stems or in some a single stem, which, however, divides immediately after leaving the heart, into a right and left stem. Of these the right stem is the thicker and divides into a common *truncus anonymus* and a descending stem; the first divides into a left and a right branch, from which the subclavian and jugular arteries of each side arise. The descending stem forms on the right side an arch, and afterwards unites with a branch from the left stem to form the descending *aorta*. Before giving off the connecting branch, which may be regarded as the continuation of the stem, the left *aorta* supplies arteries for the stomach and the mesentery[3]. The pulmonary artery divides into two branches; between each of these branches and the arch of the left and right aortæ there is a communicating branch (*ductus Botalli*), which, however, in the tortoises is consolidated and closed at an early period; consequently, the pulmonary artery becomes suddenly smaller before it arrives at the lung. In the lacertine animals also the left *aorta* gives off no branches forward, to the head or anterior limbs, but only to the intestines, except a communicating branch to the descending right

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[1] F. SCHLEMM *Anatom. Beschreibung des Bluttgefäss-Systems der Schlangen*, in TIEDEMANN u. TREVIRANUS *Zeitschrift für Physiol.* II. s. 101—124, Taf. VII. On the circulation of serpents see H. JACQUART *Mém. sur la circulation chez le Python, Ann. des Sc. nat.* 4ième Série, IV. 1855, pp. 321—364, Pl. 9—11, H. RATHKE *Bemerkungen über die Carotiden der Schlangen*, Wien, 1856 (*Denkschr. der mathem. naturw. Classe der kaiserl. Akad. der Wissensch.*).

[2] BLUMENBACH'S *Kleine Schriften.* Leipzig, 1804, 8vo, s. 70, 71.

[3] Hence CUVIER names the left *aorta* also *aorte viscérale*. See figures of the heart and large vessels in *Emys europæa* in the classical work of BOJANUS, Tab. XXIX. figs. 160, 161.

aorta, so as to form the *aorta abdominalis*[1]. By this union of the arteries from the two sides which meet at the back to form the abdominal aorta, there is formed in the reptiles a vascular ring, in which the œsophagus is situated.

In many respects the arrangement in the crocodiles is the same as in the other lizards, but there is this modification here in the structure of the heart, that it is divided into two distinct ventricles[2]. In front of the ventricles the different arteries form an elongated sac, comparable to the *bulbus arteriosus* of the fish's heart; this appendage lies with the heart in the pericardium. This arterial sac is formed by the right and left *aorta* and the pulmonary artery. The left *aorta*, which here also is a descending *aorta visceralis*, arises with the pulmonary artery from the right ventricle, and thus conveys venous blood. The right *aorta*, which divides into an *aorta adscendens* and a second descending arterial trunk, comes from the left ventricle of the heart. By this arrangement the head and the anterior limbs receive arterial blood, the viscera and the posterior parts of the body mixed blood. At the same time it is not only in the *aorta abdominalis* that a mixture of blood takes place, but there is also in the common septum (here cartilaginous) of the two aortic stems an opening concealed behind the semilunar valves, by which, as it seems, blood can pass from the right ventricle into the right aorta, when the animal is under water and the respiration for a time suspended[3]. The left *aorta*, arising from the right ventricle, corresponds with that arterial stem

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[1] See the figures in an Egyptian *Varanus* in the elegant dissertation of A. CORTI, *De systemate vasorum Psammosauri grisei*. Vindobonæ, 1847, 4to, fig. 1.

[2] The priority of this discovery is due neither to MECKEL nor to MARTIN SAINT-ANGE, but to HENTZ; *Transactions of the American Philosophical Society, New Series*. Vol. II. Philadelphia, 1825, p. 216 and foll. Comp. my *Memoir* on the heart of the Crocodile, *Tijdschr. voor. natuurl. Gesch. en Physiol.* VI. 1839, bl. 152—167.

[3] See BISCHOFF *Ueber den Bau des Crocodil-Herzen*, in MUELLER'S *Archiv*, 1836, s. 1—12, Tab. 1. In the beautiful figures, which have been often copied in later works, *ex. gr.* in the English translation of MUELLER'S *Physiologie*, we may remark that G indicates the *arteria carotis communis* (or according to RATHKE the *arteria collaris*), and by no means the left subclavian artery; E and F are the subclavian arteries. Concerning the origin of the large arteries in crocodiles, which is not always the same but presents varieties of different kinds, we cannot discourse here for want of space. Compare also H. RATHKE *Ueber die Carotiden der Krokodile und Vögel*, MUELLER'S *Archiv*, 1850, s. 184—192, and further observations by the same, MUELLER'S *Archiv*, 1852, s. 374.

of the mammalian fœtus which gives branches to the lungs, but is principally continued into the descending arch of the *aorta* (as the so-named *ductus Botalli*). The heart of reptiles, that even of the crocodiles not excepted, is a persistent fœtal heart.

There are one posterior and two anterior venæ cavæ in reptiles; the posterior cava is formed by the venous trunk of the sexual organs, the hepatic and renal veins. The venous blood of the posterior parts of the body passes for the most part through the kidneys before it returns to the heart[1].

The lungs of reptiles are larger or smaller sacs with projecting folds on the walls, whence cells arise, which are sometimes very large, and at the lowest part are often entirely deficient. Even when the lungs are large and, as occurs in many, extend far into the abdomen, the surface presented to the inspired air is rendered by this less composite arrangement relatively smaller than in mammals. When the respiration is interrupted, reptiles do not so quickly die as warm-blooded animals, and they live longer in gases which are unfit for respiration. In many serpents, many species of the genus *Coluber*, in *Vipera berus*, there is only one lung present; *Naja*, on the other hand, *Crotalus*, *Boa*, *Amphisbœna*, have two lungs, which in *Boa* are almost of equal size, whilst in others they are unequal, so that sometimes there scarcely remains a vestige of one of them, which is mostly the left lung. In the tortoises the lungs are broad and flat; they extend along the back to the pelvis. The reptiles have no bronchial artery, but the pulmonary vessels appear to supply nutrition to the lungs. The pulmonary veins always terminate in the left auricle, mostly separately, but sometimes after having united to form a single stem[2]. In the serpents the anterior part alone of the lungs receives blood from the pulmonary artery; the part that lies farther back receives blood from the abdominal *aorta*; these arteries anastomose with branches of the pulmonary

[1] Comp. p. 222. See GRUBY *Recherches anatomiques sur le système veineux des Grenouilles, Ann. des Sc. nat.* 2e Série, XVII. 1842, *Zool.* pp. 209—230. The vein which GRUBY regarded as running from the anterior abdominal vein to the heart was afterwards shewn by RUSCONI to be a cardiac vein that perforates the pericardium and falls into that abdominal vein. *Ann. des Sc. nat.* 3e Série, IV. *Zool.* p. 282.

[2] Compare on the respiration of reptiles CUVIER *Leç. d'Anat. comp.* IV. pp. 323—326, 330—332, 346, 347 (second edition of DUVERNOY, VII. 1840, pp. 26—40, 86—100, 128—146, 151—154), and MECKEL *Ueber das Respirations-system der Reptilien, Archiv für die Physiol.* IV. s. 60—89, Tab. II.

artery, and the venous branches corresponding to them return their blood to the portal vein[1]. From this arrangement in serpents, arterial blood also is mixed with venous, and like as in all the reptiles, venous blood is mixed with arterial.

The ribs of lizards and serpents serve for respiration; in the frogs, which have no ribs, inspiration is effected by the motions of the tongue-bone. Keeping the mouth closed, they fill its cavity with air through the nostrils; when the nostrils have been closed, they contract the oral cavity, raise the *larynx*, and press the inclosed air into the *glottis*. Without closure of the mouth that complete inspiration cannot be effected in batrachians by which the lungs are sufficiently distended[2]. In the tortoises the same explanation of inspiration has been given, since here the ribs are immoveable. It has, however, been shewn by experiments, that here the inspiration is not effected by deglutition, and that if an opening be made in the trachea it is continued, so that what in other animals is performed by the ribs, is here effected by the moveable belt of the shoulder-bone and clavicle. Expiration is effected partly by contraction of the abdominal muscles, partly by contraction of the lungs themselves.

In the naked amphibians, the *diplopnoa*, larynx and trachea form a whole, and in the batrachians this part consists more of larynx, in the proteïds more of trachea, that is, in the last it is more developed in length. In *Proteus* the trachea has a slip of cartilage on each side; of such a slip in the *Batrachii* the greater part is developed into a cricoïd cartilage, or into a cartilaginous ring, representing at once the thyroïd and cricoïd cartilages; at its posterior part it has transverse processes, which are afterwards developed into rings of the trachea. Moreover this trachea in batrachians is still entirely membranous, as also are the two bronchi, into which it divides, with the exception of the genus

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[1] CUVIER *Leç d'Anat. comp.* IV. p. 337. The hindmost part of the lungs is without vessels. Comp. HYRTL *Strena anatomica de novis pulmonum vasis in Ophidiis.* Pragæ, 1837, 4to.

[2] HERHOLDT shewed the necessity that the mouth should be closed during the inspiration of frogs; some of his experiments, however, of which the result was, that frogs when prevented closing the mouth quickly died, have been justly rendered doubtful by RUDOLPHI *Grundriss der Physiologie,* II. 2, s. 339. See also on this subject, and on the respiration of tortoises, HARO *Ann. des Sc. nat.* 2e Série, XVIII. *Zool.* 1843, pp. 36—50, and PANIZZA *ibid.* 3ième Série, III. 1845, pp. 230—247.

Pipa, where bronchial rings exist. In the scaly reptiles, the *haplopnoa*, the larynx, trachea and two bronchi are mostly distinguishable. The cartilaginous rings of the trachea are usually complete circles and placed close together. In many serpents the trachea is provided with rings at its lower part only, whilst the anterior part expands into a thin cellular network. The bronchi are in lizards usually very short, in the tortoises alone are they longer, especially in the land-tortoises. The bronchus does not usually divide in the lung, but ends suddenly or terminates in a membranous band. In the crocodiles and tortoises the bronchus extends throughout the lung, and is perforated by many openings, which lead into cells or sacs, whose walls are beset with small cells.

In the naked reptiles gills are present, either in their young state, or, as in *Proteus*, during the whole of life, in the latter case simultaneously with lungs, in the first before the lungs are developed. To the consideration of these gills we shall afterwards revert in the systematic arrangement of this class.

In vertebrate animals that breathe by lungs, the production of sound is effected by an arrangement at the trachea, consisting of elastic ligaments, which are caused to vibrate by the current of air. In reptiles, birds and mammals, a voice can be produced by this means, and the vocal ligaments, in the first mentioned, as in mammals, are situated at the upper part of the trachea in an organ named *larynx*. Many reptiles, however, emit no sound except only a blowing, on the rapid expulsion of the air through the glottis, as in the chameleon. Serpents give only a hissing sound when disturbed. The *glottis* lies close behind the root of the tongue, in serpents on the membranous sheath in which the tongue at its hinder part is inclosed. The *arytænoïd cartilages* of batrachians are two triangular or oval parts, externally convex, internally concave, and having a tense membrane at their inferior margin. They form a dome-like eminence, on which, between the margins of the cartilages, the opening of the glottis is situated[1]. The male of many species of frog, as of *Rana esculenta*, have two vesicles under the membrane of the tympanum, behind the angle of the mouth;

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1 Comp. Vicq. d'Azyr, *Mém. de l'Acad. des Sc.* 1779, Paris 1782, pp. 195, 196, Pl. xiii. figs. 40—44.

they open into the mouth on each side near the lower jaw, and are much distended during the croaking that is heard, especially in spring and the beginning of summer, at pairing time[1]. In the lizards the arytænoïd cartilages are usually present as distinct pieces: in most serpents merely as processes at the posterior part of the thyroïd cartilage, and forming with it a whole. When the larynx is more perfectly developed, the anterior apex of the thyroïd becomes free as an *epiglottis*. Most serpents and some lizards have an *epiglottis*[2].

The kidneys in which, as in those of fishes, a cortical and a medullary portion cannot be distinguished (p. 37), have in this class a very various magnitude and form. They are much elongated in the serpents, thick and oval in the tortoises, longitudinally oval in lizards and batrachians. In the serpents the right kidney is placed more forward than the left, in the others they lie more at the same height, and often at the back part close together. In the lizards they lie far backward, are attached to the sacrum, and extend frequently under the tail. They are mostly incised at the margin or divided into lobes by transverse grooves. In the kidneys of serpents and tortoises these divisions on the surface resemble the convolutions of the brain in mammals. The kidneys are formed of tubules, which in some proceed immediately from the ureters, and run transversely to the surface, where they terminate blindly, whilst in others they leave the branches into which the ureters divide for every lobe of the kidney. The ureters never pass from a renal pelvis, but always arise from the successive union of branches, or from the tubules of the renal substance itself. The Malpighian bodies are present in reptiles as in the rest of the vertebrate animals, and in the batrachians are sufficiently large to be seen by the naked eye. In serpents the ureters are long, and

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[1] P. CAMPER gave good figures of these parts, *Verhandelingen van het Bataafsch Genootschap te Rotterdam*, I. 1774, bl. 245—251, Pl. X. These vesicles consist of two membranes, the skin and a very thin production of the mucous membrane of the mouth. The muscular coat of the skin compresses the internal membrane; when the skin is removed the vesicle can be much more largely distended by inflation than in the natural state.

[2] HENLE has given a general and comparative view of the larynx in this class, illustrated throughout by the necessary figures, in his excellent *Vergleichend-anatomische Beschreibung des Kehlkopfs*. Leipzig, 1839, 4to.

expand in some degree before ending in the cloaca; there is no urinary bladder. In the crocodiles also, and some other lacertine animals, the urinary bladder is wanting, although it is present in most of the other lizards as well as in the tortoises and the naked amphibians[1].

According to the discovery of JACOBSON veins run on the outside of the kidney, which, like the portal vein in the liver, divide like arteries in the kidney (*venæ renales advehentes*). These venous stems are formed by the veins of the posterior parts of the body, of the tail in serpents, and in other reptiles of those also of the hinder limbs; a part only of the venous blood of these parts goes immediately to the cava or to the liver. The blood from the renal arteries and afferent renal veins is returned by other renal veins (efferent) to the vena cava[2]. Supra-renal capsules (*renes succenturiati*) are found in most reptiles, generally however small and often remote from the kidneys, situated on the inside of the kidneys near the efferent veins[3].

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[1] In the tortoises and frogs the urinary bladder is broad and is divided into two lateral parts, which in the last are very spacious and with thin walls. TOWNSON (*Observ. physiol. de Amphibiis*, Gotting. 1795, p. 29) and JACOBSON (MECKEL'S *Archiv f. d. Physiol.* III. s. 148) have not been willing to recognise as urinary bladder the part previously so named; that the ureters do not terminate in this bladder is no reason for assigning to it any other office; even in the tortoises the ureters run to the neck of the bladder or to the urethra itself, and thus the urine, like the bile in the human gall-bladder, can in no other way reach the bladder than by that of regurgitation. On the kidneys of reptiles J. F. LINK *De Amphibiorum systemate uropoëtico*, Halæ, 1817, 8vo, may be consulted. The urine of serpents is a consistent white substance which hardens on drying.

[2] Compare L. JACOBSON *De systemate venoso peculiari in permultis animalibus observato*. Hafniæ, 1821, 4to. See also the experiments with ligature of the afferent veins of A. DE MARTINO *Ann. des Sc. nat.* 1841, Tom. XVI. *Zool.* pp. 305—309, and especially BOWMAN'S description of the 'portal system' of the kidney of the *boa* in his memoir *On the structure and use of the Malpighian bodies of the kidney, Phil. Trans.* 1842, Pt. I. p. 64, Pl. IV. fig. 17.

[3] In the European fresh-water tortoise they lie on the inside of the kidneys, BOJANUS *Anat. Testud.* figs. 186, 188 P. In the frog the yellow or orange-coloured bodies situated above the kidneys and divided into elongated finger-shaped slips, were formerly supposed to be the supra-renal capsules. RATHKE and RETZIUS, on the contrary, regard as representing the supra-renal capsule yellow bands composed of granular matter that lie on the abdominal surface of the kidneys along the principal branches of the efferent veins; see NAGEL in MUELLER'S *Archiv*, 1836, s. 380, Taf. XV. fig. 4, GRUBY l. l. pp. 218—220, Pl. 10, figs. 8—10.

The organs for preparing the germ and the seed (ovaries and testes) are always in pairs, mostly of the same size and placed symmetrically on the two sides. In the serpents, however, and in the genus *Proteus* the right *ovarium* and the right *testis* lie more forward than the corresponding organs on the left side, which often also are less. The oviducts are never, as in many bony fishes and in invertebrate animals (see above, p. 38), immediate continuations of the ovary, but have free openings into the cavity of the abdomen, as for instance in batrachians, where they are situated in the uppermost part of the abdominal cavity close to the heart; here the oviducts are very tortuous, and have when straightened out a length of more than two feet. The lower ends of the oviducts exhibit thicker walls, and have, especially in the species that are viviparous, as the land-salamanders, a great width. In the frogs the lower apertures of the tubes terminate in a membranous sac capable of much distension from the eggs, and to which the scarcely appropriate name of uterus has been given. In the tortoises the inferior apertures of the ovaries are situated near the neck of the urinary bladder, at the upper part of the *cloaca*.

The ovaries have the form either of sacs,—which in the tailed *diplopnoa* are undivided, but in the batrachians, serpents and lizards are divided into cells,—or of laminæ, on the abdominal surface of which the eggs are developed, and when ripe are separated, as in the crocodiles and tortoises.

The testes lie on each side of the spinal column, in front of the kidneys in lizards and serpents, in batrachians on the fore part of the kidneys, in chelonians on the hind part of the same, which are always situated more towards the back. In the salamanders the testes are divided into roundish bodies, sometimes different in number on the opposite sides (two, three or four), placed behind one another.

The arrangement in frogs, already noticed by SWAMMERDAM, is remarkable, viz. that the ureters are also the efferent vessels[1]. In

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[1] *Bijbel der nat.* pp. 795, 796. What RATHKE and others supposed to be a *vas deferens* distinct from the *ureteres*, is, according to BIDDER, a communicating vessel covered with dark pigment forming an anastomosis between the iliac artery and the axillary; F. H. BIDDER *Vergleichend-anatomische u. histologische Untersuchungen über die männliche Geschlechts- und Harnwerkzeuge der nackten Amphibien.* Dorpat, 1846, 4to, s. 21.

the salamanders some *vasa efferentia* from the testes unite to form a longitudinal canal, from which many tortuous branches arise, whose union forms an *epididymis* near the testes, and which afterwards run straight outwards and are inserted into the efferent vessel[1]. In the tortoises, to each of the efferent vessels a long convoluted organ resembling intestine is attached before they terminate in the cloaca. A penis does not exist in the frogs and most of the naked amphibians, but in the land- and water-salamanders there is an imperforate and very vascular penis of an inversely heart-like form[2]. In the scaly reptiles, the *haplopnoa*, there is on the contrary always an external sexual organ for copulation. This penis is a double cœcal tube, which can be inverted like the finger of a glove, in most of the lizards and the serpents. A furrow runs along the inside of the tube, which on erection and inversion becomes an external furrow for transmission of the sperm. This double penis lies on the outside of the cloaca on the dorsal surface or under the tail. In the crocodiles and chelonians, on the other hand, the penis is simple, composed of two fibrous bodies which have coalesced in the mid-plane, and with a channel or groove on the upper part, which is covered by an erectile spongy body (*corpus cavernosum*) that is enlarged into a gland at the extremity. This organ is attached to the anterior wall of the *cloaca*, where in the females of these animals a *clitoris* is also attached[3].

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[1] This *epididymis* lies in front of the kidneys, of which BIDDER considers it to form a part, so that, as in the frogs epididymis and kidney are united to form a whole, in the salamanders also these organs are not distinct (l. l. p. 36). Moreover from the firmer and posterior kidney, which is usually regarded as the sole kidney, there proceed in the salamanders a number of ducts which unite to form a short *ureter*. According to DUVERNOY the *ureter* opens separately, according to BIDDER united with the *vas deferens*, into the *cloaca*. See DUVERNOY *Fragments sur les organes génito-urinaires des Reptiles*, Paris, 1848, *Mém. de l'Acad. des Sc. de Paris, Sav. étrang.* XI. Pl. I. fig. 9.

[2] See J. H. FINGER *De Tritonum genitalibus eorumque functione.* Marburgi, 1841, 4to, pp. 22, 23, figs. 2, 3. Compare also on the uro-genital apparatus, VON WITTICH *Beiträge zur morphologischen u. histologischen Entwickelung der Harn- und Geschlechtswerkzeuge der nackten Amphibien, Zeitschr. f. wissensch. Zool.* IV. 1852, pp. 125—167, Taf. IX. X.; the same, *Harn- und Geschlechtsorgane von Discoglossus pictus und einiger anderer aussereuropäischer Batrachier*, ibid. pp. 168—177, Taf. X. figs. 1, 2.

[3] Comp. J. MUELLER *Bau der erectilen männlichen Geschlechts organe*, &c. Berlin 1838, (*Abh. der Königl. Akad. d. Wiss. zu Berlin, Physik. Kl.*) Tab. III. figs. 4, 5. On the organs of propagation in reptiles, besides the works already quoted, may be consulted RATHKE *Ueber die Entwickelung der Geschlechtstheile bei den Amphibien,*

The eggs of reptiles are various in form. In the batrachians they are covered in the oviducts with a gelatinous substance swelling greatly in water, in which they are developed. The eggs of lizards and turtles have a leathery shell; in other tortoises the shell is harder and contains more carbonate of lime, less however than the eggs of birds. The membranous shell consists in most cases of many layers of very fine fibres, or of different films of various tissue.

In the impregnated egg of the frog the remarkable cleaving or regular division of the yolk was first observed[1], which precedes the existence of the *embryo*, and which we have already alluded to in different invertebrate animals and in fishes, and which also occurs in the egg of mammals. In the development of the animals of the present class there is a remarkable difference; those reptiles which have a smooth skin and at first breathe by gills, or which have both lungs and gills (*diplopnoa*), resemble fishes in the development of the embryo, for neither *amnion* nor *allantois* is formed (see above p. 40). In the *haplopnoa*, on the other hand, that is in those which breathe by lungs from the beginning and never possess gills, as the serpents, lizards, and tortoises, there is formed in the *embryo*, as in birds and mammals, an *amnion* and an *allantois*. In the *diplopnoa* there is no external yolk-sac constricted by the abdomen; the animal leaves the egg in a still very imperfect condition, as a larva without limbs and with external gills, and the development continues after birth, until the lungs arise, and with them the circulation of blood is

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Beiträge zur Gesch. der Thierwelt, III. 1825, s. 19—48, and *Untersuchungen ueber die Geschlechtswerkzeuge der Schlangen, Eidechsen und Schildkröten, Abhandlungen zur Bildungs- und Entwickelungsgesch.* I. Leipzig, 1832, s. 21—44, Taf. 2. In the tortoises there is on each side of the penis near the groove a canal that terminates blindly; it is a production of the peritoneum. In the crocodiles also there proceeds on each side a funnel-shaped prolongation from the peritoneum to the *cloaca*, but here it opens at the base of the penis or clitoris. Comp. on these peritoneal canals ISID. GEOFFROY SAINT-HILAIRE and J. G. MARTIN *Ann. des Sc. nat.* XIII. 1828, pp. 153—206, MAYER *Analecten für vergl. Anat.* Bonn, 1835, 4to, s. 44, 45, Tab. III. fig. 9.

[1] PREVOST *et* DUMAS *Ann. des. Sc. nat.* II. 1824, p. 110. See also RUSCONI *Developpement de la Grenouille commune*, Milan, 1820, 4to, p. 10, Pl. 2, fig. 3. But hints are met with in the works of earlier observers which prove that this phenomenon had not entirely escaped them, although they formed a different notion respecting it from that afterwards given by PREVOST and DUMAS; see *ex. gr.* SWAMMERDAM *Bijb. d. nat.* Tab. 48, figs. 5, 8. Compare on the changes of the egg and the impregnation in frogs a memoir of NEWPORT *Philos. Transact.* 1851, Part I. pp. 169—242.

changed[1]. In the other reptiles the *embyro* leaves the egg in a much more perfect state. The development of the young in the egg is effected, according to different external circumstances of temperature, &c., in different periods of time. In many serpents and lizards the development begins before the egg is laid, in the body of the parent, and in some the membrane of the egg is broken by the young one before birth. In the tortoises, on the contrary, development begins after the egg has been laid, and is completed only after the lapse of several weeks[2].

Let us now consider the organs of animal life. In the central nervous system we remark that the spinal marrow is constantly large in comparison with the brain. From the great length which it has in serpents it is very thin, whilst, on the contrary, in frogs, whose spinal column consists of only a few vertebræ, with remarkable shortness, it is much broader. In the middle of the spinal cord, as in fishes, there runs a canal which is continued into the fourth ventricle of the brain. Where the nerves for the limbs arise, a swelling or expansion of the cord is seen corresponding to the size of the limbs; in frogs, for instance, this swelling is very conspicuous at the place where the lumbar nerves arise for the hinder limbs[3].

The brain still forms in reptiles only a small part of the weight of the body. According to the statements of HALLER and CUVIER (see the places quoted above p. 42) the ratio in the frog is $\frac{1}{172}$, in the ringed snake (*coluber natrix*) $\frac{1}{702}$, in a land tortoise $\frac{1}{2240}$, in a turtle, according to CALDESI, $\frac{1}{5088}$. The numbers given are sufficient

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[1] Compare, besides the works already quoted in the preceding note, VON BAER *Ueber Entwickelungsgeschichte der Thiere*, II. 1837, s. 280—295; K. B. REICHERT *Das Entwickelungsleben im Wirbelthier-Reich*, Berlin, 1840, 4to, s. 5—85; and C. VOGT *Untersuchungen über die Entwickelungsgeschichte der Geburtshelferkröte*, Solothurn, 1842, 4to.

[2] We cannot here unfold the history of development. Besides the contributions to it in earlier works (as for the development of lizards by EMMERT and HOCHSTETTER, REIL'S *Archiv.* X. s. 84—122, of tortoises in the work of the celebrated TIEDEMANN, *Zu* S. T. VON SŒMMERRING'S *Jubelfeier*, 1828, 4to), this subject has given occasion to two excellent works by RATHKE in later times; *Entwickelungsgeschichte der Natter*, Konigsberg, 1839, 4to, and *Ueber die Entwickelung der Schildkröten*, Braunschweig, 1848, 4to.

[3] CARUS *Versuch einer Darstellung des Nervensystems und insbesondere des Gehirns*. Leipzig, 1814, 4to, s. 170—174, Tab. III. figs. 1, 2 *c*, the spinal marrow of the frog; see for the tortoise BOJANUS l. l. Tab. XXI. figs. 83, 84, p. 87.

to shew that these proportions afford no measure of the greater or less perfection of organisation. The brain of reptiles presents on the upper surface a great resemblance to that of fishes. The hemispheres are still without convolutions, but always hollow internally (*lateral ventricles*), and surpass in circumference the second portion of the brain, the mass of the *corpora quadrigemina* or optic lobes, which in the bony fishes constitute the principal mass of the brain. These optic lobes are larger in proportion to the size of the eyes, as in the chameleon; they are hollow internally; between them and the hemispheres, and partially covered by both, are placed the *thalami* of the optic nerves, which here are still small and, as always, without an internal cavity. In front of the *corpora quadrigemina* lies the pineal gland, not covered by the ventricles of the brain. The cerebellum is feebly developed in frogs, and consists almost solely of a thin plate of medulla where the two lateral walls of the fourth ventricle approach each other. A laminated part, of a red colour, is attached to its posterior margin, and covers the fourth ventricle of the brain at its upper part[1]. A similar part is present in tortoises, and has been named by BOJANUS the vascular covering of the fourth ventricle. Moreover in these animals, as also in the lizards and especially in the crocodiles, the cerebellum is more fully developed. On the under surface of the brain there is not found, any more than in birds and fishes, the transverse commissure in front of the cerebellum above the *medulla oblongata*, which in man and mammals forms the bridge of VAROLIUS. In the lizards, especially in the crocodiles and in the serpents, the brain is broader, whilst in the tortoises, as in the frogs, it is narrow and elongate[2]. The cerebral nerves correspond, on the

[1] CARUS, op. cit. s. 175—179, Tab. III. figs. 1—3.

[2] The brain of *Alligator* has been figured by MUELLER, *Vergl. Neurol. der Myxinoïden*, Tab. IV. fig. 1; that of the fresh-water tortoise by BOJANUS, whose figures have been in part copied in WAGNER *Icones physiol.* Tab. 23 (which may be consulted for the entire comp. anat. of the brain); of the brain of *Rana*, besides CARUS, KUHL also gave figures, as also of *Agama marmorata*, *Lacerta agilis* and *Coluber natrix*, *Beiträge zur vergl. Anatomie*, Tab. III. s. 57—60; the brain of *Proteus* has been described and figured by TREVIRANUS, *Comment. Societ. Gœtting.*, Vol. IV. 1819, pp. 197—202, Tab. I. II. by RUSCONI *Del Proteo anguino Monografia*, Tab. IV. fig. 4, and by VAN DEEN *Tijdschr. voor nat. Gesch. en Physiol.* I. bl. 127, Pl. VI. fig. 2; of the brain of the chameleon TREVIRANUS has given a description and figures, *Beobachtungen aus der Zootomie u. Physiol.* 1839, s. 93, 94, Tab. XII. figs. 81, 82, &c.

whole, in number of pairs and in origin, with those of the higher animals and of man. In some instances the *nervus glossopharyngeus* is only a branch of the *nervus vagus*. In the *diplopnoa* the motor nerves of the eye are united to the course of the fibres of the first branch of the fifth pair. The *vagus* in the larvæ of salamanders and frogs, and in those genera of *diplopnoa* where the gills are permanent, gives off, as in fishes (p. 45), a nerve that runs along the side (*nervus lateralis*)[1]. The hypoglossal nerves in the *diplopnoa* arise from the spinal cord; in the frogs they are the first pair of spinal nerves; in the salamanders they are formed by the first two pairs[2].

The cephalic portion of the great sympathetic nerve is connected with the vagus, the fifth and sixth pairs of nerves and the facial nerve. In the serpents the anterior part of the sympathetic nerve of the trunk is wanting, and its place is supplied by the vagus nerve. Lower down in the trunk branches proceed from each of the spinal nerves to the viscera, and are connected by arched loops which represent the sympathetic. In the frogs, on the other hand, and the tortoises, the trunk of the sympathetic is very conspicuous on each side of the spinal column, and in the last of these the trunks of the arteries of the intestines are surrounded by very beautiful plexuses of nerves[3].

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[1] VAN DEEN *Disquisitio physiologica de differentia et nexu inter nervos vitæ anim. et organic.* L. B. 1834, p. 96, figs. IV. V., and *Tijdschr.* l. l. pp. 112—129.

[2] See A. W. VOLKMANN *Bau und Verrichtungen der Kopfnerven des Frosches*, MUELLER'S *Archiv*, 1838, s. 70—89, Taf. II. figs. 1, 2; C. VOGT *Zur Neurologie von Python tigris*, ibid., 1839, s. 39—58, Taf. III. figs. 1—4. H. BENDZ *Bidrag til den sammenlignende Anatomie af Nervus glossopharyngeus, vagus, accessorius og hypoglossus hos Reptilierne.* *Danske Vidensk. Selsk. math. og naturvidensk. Afhandl.* X. 1843, pp. 113—152, with 10 plates; J. G. FISCHER *Amphibiorum nudorum Neurologiæ Specimen primum. Accedunt tabulæ* 3 *æri incisæ.* Berolini, 1843: this first (and only?) part of FISCHER'S work contains descriptions and figures (larger than natural) of the basis of the brain and the cerebral nerves of *Bufo palmarum, Hyla arborea, Bombinator igneus, Pelobates fuscus, Pipa dorsigera, Salamandra terrestris, Triton cristatus, Rana esculenta, Hypochthon anguinus* and *Cœcilia annulata;*—JEFFRIES WYMAN *Anatomy of the nervous system of Rana pipiens.* Washington City, 1853, 4to, 2 Plates (*Smithsonian Contributions to Knowledge*, Vol. V. art. 4). The *Rana pipiens* of WYMAN is evidently that large frog called by others *Rana mugiens. Rana pipiens* of SCHNEIDER and SCHREIBERS is the *Rana halecina* of DAUDIN and MERREM, *Rana palustris* GUÉRIN, *Iconogr. du R. anim., Rept.* Pl. 26, fig. 1, a species not larger than our common frog.

[3] Comp. CARUS op. cit., s. 179, 180, Tab. III. fig. 2; WEBER *Anat. comp. nervi sympathici*, pp. 41—49, Tab. III. fig. 4; BIDDER u. VOLKMANN *Die Selbständigkeit des*

Amongst the organs of sense in reptiles that of feeling, or the modification of it as tact, comes in the first place under consideration. The skin of animals is not merely adapted as a covering to protect them from injurious external stimulants, but serves at the same time as a seat for feeling. In this class, however, the skin is generally to be regarded rather as a protective covering, since scales or hard shields render it unfit for feeling. The true skin (*corium*) is in the greater number very firmly connected to the muscles or bones which are situated beneath it. In the frogs, on the contrary, it forms a loose sac, except only on the head and the extremities of the limbs; and this sac, which may be inflated, is attached to the subjacent parts, only here and there at the back or near the joints, by filaments of nerves and vessels or fibrous tissue; a serous fluid, lymph, occupies the space between the skin and the muscles below it. The corium in this class is always composed of several layers of fibres (sometimes of very many when its thickness is considerable), which lie close together: and it has been noticed that the direction of the fibres in each of the layers alternates with that of the previous and succeeding layers, making with them nearly a right angle. The casting or moulting of the cuticle is very general also in the naked *diplopnoa;* in the serpents the external covering of the eyeball is moulted with the cuticle. In some lizards, in the crocodile, &c., the scales or scutes are ossified. Perhaps by grasping of objects with the tail, in certain lizards, or with the whole body, as in serpents, a perception of the form and surface of such objects may be procured. Probably the tongue in some serves as an organ of tact (see above p. 211)..

Taste appears to be feebly developed, for most reptiles gulp their prey very rapidly. TREVIRANUS, indeed, from having observed that frogs, when by chance they have swallowed what is disagreeable to them, quickly reject it again, would conclude that they possess the faculty of distinguishing their food by taste[1]; but this may be regarded, and perhaps with greater truth, as a proof that the stomach

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sympathischen Nervensystems, Leipzig, 1842, 4to, s. 32, 33, Tab. III. fig. 7; BOJANUS *Anat. Testud.* pp. 110—113, Tab. 23, figs. 116, 117; GILTAY *Diss. de Nervo sympathico*, pp. 75—96; MUELLER *Vergl. Neurologie der Myxinoiden*, s. 59—63, Tab. IV. figs. 3, 4, 5.

[1] *Biologie*, VI. s. 245.

receives a disagreeable stimulus from certain objects. The tongue is here principally of service as an instrument for seizing or swallowing the food, or, as we have just said, as an organ of touch. In many toads and frogs the tongue is membranous, smooth, covered with mucus, attached in front and free behind, and when at rest thrown back in the mouth, whilst in seizing the prey it is thrown over, and, with the hinder part forward, is extended from the mouth. The *Pipa* and the genus *Xenopus* have no tongue at all. In the salamanders the tongue is free at the edges alone. In most serpents it is very smooth, and is divided at the apex into two flexible filaments; its base is inclosed in a membranous sheath; the same disposition is found in certain lizards. The prehensile tongue of the chameleon is capable of great extension, and is knob-shaped anteriorly. In most lacertine animals the tongue is elongate, triangular, slightly notched in the middle at the apex, and but seldom, as in *Iguana*, closely beset with fine papillæ or villi, ordinarily only wrinkled or covered with scales. The tongue in the crocodile is membranous, attached at the point and sides to the bottom of the oral cavity between the lateral pieces of the lower jaw, so that formerly its presence was not recognised. Its hinder part is however capable of motion and can be elevated by the tongue-bone, so that a fold or plait is formed which covers the entrance into the œsophagus and prevents the water from entering it. Deglutition therefore, by which this fold is again depressed, is not performed in water but on dry land[1]. The tongue of the tortoises is thick and membranous; in the turtles without papillæ, but with many furrows on the surface, in the land-tortoises covered with numerous very thin flat villi thickly set. In the fresh-water tortoises some small papillæ alone are set on the fore part of the tongue, whilst elsewhere it is free from them, though in some degree furrowed. In these last, as in *Iguana*, taste is probably more fully developed than in other reptiles.

The cavity of the nose in reptiles has apertures opening into the mouth or the gullet, a communication which prevails in all vertebrate animals that breathe by lungs. The distance between

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[1] A. De Humboldt *Recueil d'Observations de Zoologie et d'Anat. Comp.* Paris, 1811, I. p. 10, Pl. IV. No. X. Owen *Catal. of the Physiol. Series of Comp. Anat. of the Roy. Coll. of Surgeons*, II. London, 1834, p. 161, Pl. XXVIII. fig. 1.

the anterior and posterior apertures of the nasal cavity is very short in the batrachians, very long, on the other hand, in the crocodiles, in which the anterior opening is surrounded by the intermaxillary bones alone, and is placed on the upper part of the jaw close to its apex; the posterior, a heart-shaped opening at the posterior margin of the palate, is circumscribed by the pterygoïd bones. In the chelonians this cavity is wide and short, and has at the fore part of the bony head an almost quadrangular opening, which is bounded by the lateral ethmoïd or anterior frontal bones and by the intermaxillary bones. The reptiles never have frontal sinuses comparable to those of mammals. Some cartilaginous folds, continuations of the cartilaginous partition of the nasal cavities, take the place of the superior and inferior turbinated bones, and are covered with a highly vascular mucous membrane provided with black pigment. A cribriform lamella is absent here, as it is in fishes. The olfactory nerve, which is very large, proceeds to the nasal cavity of its side, divides there into branches, and is distributed to the folds of the mucous membrane. In some reptiles there are cartilaginous parts and layers of muscular tissue near the nostrils, by means of which these apertures can be dilated and contracted[1].

All the reptiles have two eyes. In most, especially in serpents, they are small in comparison with the size of the body; in the frog, however, in the geckos and the chameleon, they are large. In some they are covered by the skin; in *Proteus*, the skin is only slightly attenuated, and the stimulus of light appears, according to the experiments of RUDOLPHI, to produce little effect upon this animal. In the serpents and in the genus *Gecko* also there are no eyelids, but the skin, becoming thinner and transparent, passes over the anterior surface of the eye-ball and forms with the conjunctiva, immediately surrounding the eye-ball, a capsule which is moistened by the lachrymal fluid[2]. In the remaining reptiles there are three eyelids present, of which one is situated perpendicularly at the inner

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[1] See on the olfactory organ of reptiles, A. SCARPA *Anatomicæ disquisitiones de Auditu et Olfactu*, pp. 75, 76; compare also DE BLAINVILLE *Principes d'Anat. comp.* I. pp. 324—330.

[2] On the lachrymal glands of serpents see J. CLOQUET in *Mém. du Mus. d'Hist. nat.* VII. 1832, pp. 62—84, Pl. II.

angle of the eye, behind the two horizontal eye-lids. The third eye-lid (*membrana nictitans*) and the lower have often a greater extent of motion than the upper. With the third eye-lid a special lachrymal gland (*glandula Harderi*) is in connexion, as in birds. The proper lachrymal gland, which lies on the outside of the eye-ball, is often very large, especially in chelonians. The form of the eye-ball usually differs much from that of a regular sphere. In the chelonians and in most of the lacertine animals, at the anterior part of the cornea, there is a ring of bony plates which support the eye-ball. The lens is more or less spherical, in front however mostly somewhat flatter than on the posterior surface. In many of the lacertine animals a fold covered with black pigment runs obliquely from the bottom of the eye-ball through the vitreous humour to the lens, and corresponds with the *pecten* in the eye of birds[1]. The pupil of the eye is mostly round; in the crocodile it is an elongate rhomboïdal fissure.

The organ of hearing presents a gradual scale of development from the simple structure of fishes to that of birds. The labyrinth is, as in the cartilaginous fishes, distinct from the cavity for the brain, and is inclosed in the petrous bone, or often in a part of the occipital bone also. The vestibule is filled with a whitish fluid, containing microscopic crystals of carbonate of lime. There are three semicircular canals and a *fenestra ovalis* (*foramen vestibuli*) present; in the serpents, lizards and chelonians (the *haplopnoa*) there is in addition the commencement of a cochlea and a *fenestra rotunda* (*foramen cochleæ*). The cochlea appears to be most developed in the crocodiles and formed almost as in birds; a membranous partition, extended between two cartilages, divides the internal space of the cochlea into two cavities (*scala tympani* and *scala vestibuli*). In both these fundamental forms of the auditory organ, in the imperfect form of the *diplopnoa* and in the higher of the *haplopnoa*, a tympanic cavity may be present or may be absent; where there is a tympanic cavity, there is at the same time a tube which conducts from it to the pharynx (*tuba Eustachii*). This is the case in most of the frogs, where the tube is very wide; in some tailless *Batrachii* and in all

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[1] This production is figured by D. W. SŒMMERRING in *Monitor, De Oculorum sectione horizontali*, Tab. III. In *Iguana* it is more developed, and forms two folds, l. l. p. 60.

the tailed, on the other hand, the tympanic cavity is wanting; in like manner, it is wanting in the serpents. The *membrana tympani*, attached behind the quadrate bone, lies free in some, yet in others is concealed under muscles and skin. An external auditory *meatus* is wanting as well as an external ear; in the crocodiles alone is a vestige of this last present in a fold of skin lying above the membrane of the tympanum, which has some resemblance to an eye-lid. In the tailed batrachians and in the genus *Typhlops* there is a cartilaginous plate by which the *fenestra ovalis* is covered, as the single ossicle of hearing; to this the base of the *stapes* in the human auditory organ corresponds. To it in most a long stile-shaped ossicle (*columella*) succeeds, which in the serpents penetrates amongst the muscles, but in the reptiles provided with a tympanic cavity is prolonged to the membrane of the tympanum, and is mostly attached to it by a small distinct cartilaginous piece[1].

The muscles in this class are red, although paler than in birds and mammals. The arrangement of them is much more complicated than in fishes, where the large lateral muscle (see above, p. 50) composes the chief mass, extending also over the abdomen. In this respect the Proteïds and the larvæ of salamanders still greatly resemble fishes, but in other reptiles the dorsal portion alone of these lateral trunk-muscles remains, whilst in the tail only this muscular arrangement persists on the under surface also. On the other hand, the system of the intercostal muscles is developed, to which also the straight muscles of the abdomen belong, and the system of the lateral abdominal muscles. On this account, as well as from the development of the limbs in most orders of reptiles, a great uniformity prevails in the arrangement of the muscles in them and in man, and a common plan in the muscles of vertebrate animals is as unmistakable as in the other chief parts of their organisation[2]. The

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[1] Compare, besides SCARPA l. l. pp. 23—31, especially C. J. H. WINDISCHMANN *De penitiori auris in Amphibiis structura*. Lipsiæ, 1831, cum tab.; see also MUELLER *Physiol.* II. s. 414—416. (*Elements of Physiology*, translated by Dr BALY, II. pp. 1233—1235.)

[2] On the myology of the *Reptilia*, besides the general works on comp. anatomy, may be consulted BOJANUS for the tortoises, D'ATON for the serpents (*Muskelsystem eines Python bivittatus*, MUELLER'S *Archiv*, 1834, pp. 346—364, s. 432—450. s. 528—543,) ZENKER (*Batrachomyologia*, Jenæ, 1825, 4to), and especially DUGÈS (*Recherches sur l'ostéologie et la myologie des Batraciens*, Paris, 1835, 4to) for the batrachians. Comp.

motions also in these animals are not very different; some are able to swim and spring, others run and climb; most have only a creeping motion. A single genus alone (*Draco* amongst the lizards) is able in some degree to fly, or rather flutter, by means of an expansion of the skin along the sides of the body which is sustained by the elongated ribs. One genus of a former period of the world (*Pterodactylus*) was able most probably to fly in a proper sense by means of a membrane which was supported by a very long finger.

The intelligence of reptiles is very feebly developed, and in this respect they stand scarcely on a higher footing than fishes. They grow slowly and live long; in temperate and cold regions they undergo hybernation or winter-sleep; perhaps many in warm climates have a summer-sleep, whilst the rainy season causes them to emerge again from their concealment. They are very tenacious of life; some remain alive for months in captivity without food; they can endure great heat and cold[1]. The irritability of the muscles persists for a long time after death, as it also does in amputated parts of the animal. The reproductive power is very great, especially in water-salamanders; in these not only the tail and legs that have been removed grow again, but the eye also can be restored, if only the entire ball as far as the optic nerve be not cut away[2].

The geographic distribution of reptiles affords occasion for some general conclusions, which perhaps are the more interesting because the species of this class, from being less under the influence of man than those of the other classes of vertebrate animals, have not been forced from their original residences or introduced into other regions[3]. In cold regions the number of genera is very small, and in the tropics alone is there presented a full exhibition of this class.

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also the elaborate compilation of RYMER JONES, in his article *Reptilia* in TODD'S *Cyclopædia*, IV. pp. 273—287.

[1] BLUMENBACH observed a tree-frog, that had been stiffened and frozen in the ice, come to itself again, when the ice had melted, and move and live for a long time afterwards. *Kleine Schriften*, s. 98.

[2] Comp. C. BONNET, *Œuvres d'hist. nat. et de Philos.* XI. 8vo, 1781, pp. 62—179; BLUMENBACH'S *Kleine Schriften*, s. 128—130.

[3] Interesting contributions to knowledge on this subject, especially in respect of serpents, are to be found in H. SCHLEGEL, *Physionomie des Serpens*, La Haye, 1837, 8vo, pp. 195—251; translated into English (abridged) by THOS. STEWART TRAIL, M.D. &c. Edinburgh, 1843.

Of the division of the frogs some species are found in every region of the world. The genus of the tree-frogs is peculiar to temperate and warm countries, and the species belonging to it are especially numerous in America. The genus *Pipa* belongs exclusively to South America. In Africa only few species of toads and frogs are met with. Most of the genera of serpents, particularly those of poisonous serpents, belong to warm regions; the rattle-snakes (*Crotali*) are found in America alone, the spectacle-serpents (*Najæ*) only in the old world. Amongst the serpents that are not poisonous the *Pythons* belong to the eastern hemisphere, the *Boas*, some smaller species excepted, to America. Africa has only few species of serpents; in most of the islands of the southern Pacific they are absent entirely. Amongst the lacertine animals most of the forms are restricted to warm countries, especially the family of the Iguanoïds so rich in species. The genera *Chamæleon*, *Varanus* and *Agama* (*Trapelus*), are proper to the eastern hemisphere, the last almost exclusively to Africa; to Asia in particular that of the flying lizards (*Draco*) is limited, and the sub-genus of the *Gavials;* to America, on the other hand, the sub-genus of the *Caimans* or *Alligators*, amongst the crocodiles, belongs; in America exclusively are species of the genera *Anolis*, *Polychrus*, and some others of the *Iguanoïds* found, whilst still other genera are common to both hemispheres. Amongst the tortoises, the genus *Chelys* or *Matamata* is peculiar to South America alone; the land-tortoises (*Testudines*) are found in the warm regions of the old and new world, especially in Africa; the turtles also are most numerous in the seas of warm regions. Of the fresh-water tortoises different species are found indeed in temperate regions, principally of North America, yet still the greatest number belong to tropical lands. Since then some species of lizards, serpents and frogs are found in cold regions[1], of which the frogs are the most numerous in species and especially in individuals, whilst, on the contrary, no tortoises live in these regions, being limited to warm countries, the frogs and tortoises thus form the two extremes in the geographic distribution of the reptiles: of which the first-named have the widest dispersion in

[1] In Sweden, for instance, *Coluber natrix*, *Vipera berus*, *Lacerta agilis* are found.

cold regions, whilst the last are the most limited to warm countries; the mean between these two extremes is formed by the lizards and serpents.

The fossil reptiles are of greater interest for the knowledge of the secondary mountain strata than any other vertebrate animals; most of the extinct lacertine animals occur in the Jura-lime, or in the Liassic and oölitic formations; in the tertiary formations some remains of serpents and batrachians have been observed.

SYSTEMATIC

ARRANGEMENT OF REPTILES.

CLASS XV.

REPTILIA.

VERTEBRATE animals with red, cold blood; with heart pulmonary and also aortic, a single or double ventricle and two auricles; mostly oviparous; covered with scales, scutes or naked skin. Respiration in some pulmonal and branchial, with branchiæ either persistent for the whole of life, or disappearing in the adult state.

SECTION I. *Reptilia diplopnoa* s. *Psiloderma.*

Branchiæ deciduous or persistent. Skin glutinous, smooth, mostly destitute of scales, sometimes with colourless thin scales concealed amongst folds of skin. Two occipital condyles. Labyrinth furnished with fenestra of vestibule alone.

Compare on this division J. J. TSCHUDI *Classification der Batrachier mit Beruchsicktigung der fossilen Thiere,* Neuchâtel, 1838, 4to, (printed separately from the *Mémoires de la Société des Sc. nat. de Neuchâtel*). The name *Dipnoa* was first employed by F. S. LEUCKART for these animals; J. MUELLER limited the characters of this division by different anatomical peculiarities; but the division of the class into two principal groups is to be referred to MERREM, who gave, in his *Tentamen systematis Amphibiorum* (1820), to this division the name of *Batrachia.*

BRONGNIART undoubtedly made the first advance towards a natural division of the reptiles, who (in the beginning of this century) adopted four orders of this class: *Chelonii, Saurii, Ophidii* and *Batrachii;* the second advance was the union of the three first-named orders into a common division, and the placing of this division on a level with that of the *Batrachii.* Some writers go still farther, too far according to us, in adopting two classes for

reptiles, as was done by DE BLAINVILLE, and followed by others afterwards, as, for instance, C. L. BONAPARTE. The name of *Amphibia* was given to the division of the *Diplopnoa*, whilst that of *Reptilia* was restricted to the *Pholidota* of MERREM or *Monopnoa* of FITZINGER (*Ophidii, Saurii, Chelonii*).

It appears to us that the naked or diplopnoic reptiles may be divided into three natural orders, which correspond as analogous groups to the three orders of scaly or haplopnoic reptiles. We have thus serpentine, lacertine and chelonian *Diplopnoa*. This conception conducts us to a division which corresponds with that proposed by DUMÉRIL and BIBRON.

ORDER I. *Ophiomorpha* s. *Peromela*.

Feet none. Body anguiform, round, with skin ringed by transverse wrinkles.

Family I. *Cæciliæ*. Characters of the order those of the single family. Teeth subulate, recurved in jaws and palate. Eyes concealed by skin, very small or indistinct. Vent almost at the extremity of body, tail none.

As early as 1807 DUMÉRIL pointed out the affinity of the genus *Cæcilia* L. with the *Batrachii;* OPPEL afterwards removed them to this division, when previous writers had placed them with the serpents. The discovery of two branchial apertures, in a young specimen of *Cæcilia glutinosa* (*hypocyanea* VAN HASSELT) in the Leyden Museum, by J. MUELLER in 1830, has placed the natural affinity of this genus beyond all doubt. The vertebræ, as in the fishes and in *Siren, Proteus,* &c. are connected together by conical cavities, which are filled with a cartilaginous or gelatinous substance (a remain of the *chorda dorsalis*).

Compare on the *Cæciliæ*, SCHNEIDER *Hist. Amphib.*, Fasc. II. pp. 359—388; HEMPRICH *Cæcilia ophidiorum genus recensuit et illustravit, Verhandl. der Gesellsch. naturforsch. Freunde zu Berlin,* 1829, s. 284—296; J. MUELLER in TIEDEMANN *u.* TREVIRANUS *Zeitschr. f. Physiol.* IV. 2, 1832, s. 213—222, Taf. XVIII., and in his *Archiv f. Physiol.* 1835, s. 391—398, Taf. VIII. figs. 12—14. The scales were first observed by SCHNEIDER, and afterwards described more particularly by MAYER (*Nov. Act. Acad. Cæs. Leop. Car.* Tom. XII. p. 2; *Zeitschr. für Physiol.* III. 1829, s. 254—256. They are wanting in *Cæc. annulata*).

Cæcilia L.

Sp. *Cæcilia glutinosa* L., SEBA *Thesaur.* II. Tab. 25, fig. 2, LINN. *Mus. Ad. Frid.* Tab. IV. fig. 1; very numerous annular folds, forming on the middle of the abdomen an angle, which is open forwards; dirty brown or blackish

with a yellow stripe along the sides; Java, Ceylon. The species from South America are more numerous, amongst which is the long and very thin *Cœcilia lumbricoïdea* DAUD., *Cœcilia tentaculata* L. in part, LINN. *Mus. Ad. Frid.* Tab. v. fig. 2, DAUD. *Rept.* VII. Pl. 92, fig. 2, from Surinam. LINNÆUS unites this with another, entirely different, species previously described and figured by him in the *Amœn. Acad.* I. Tab. XVII. fig. 1 as *Cœcilia tentaculata;* this is said to be from Surinam. The Leyden Museum received a *Cœcilia* from the coast of Guinea that agrees with it.

The genus *Cœcilia* counts scarcely ten species. Hence a division of it, according to less essential characters, like those on which the new genera *Siphonops* WAGL., *Epicrium* WAGL. (*Ichthyophis* FITZ.) and *Rhinatrema* DUM. *et* BIBR. are founded, is not necessary. These characters are derived especially from the position of two small grooves, not unlike the nostrils, either under these or under the eyes. More important is the prolongation of the head above the mouth in *Epicrium* and *Cœcilia*, which is not found in *Siphonops*, and more particularly the presence of two rows of teeth in the under jaw in *Epicrium* (*Cœcilia glutinosa*), remarked by MUELLER, which would be valuable characters if they were constant. *Archiv* l. l. p. 397.

ORDER II. *Saurobatrachi* s. *Sozura.*

Feet four or two anterior. Tail persistent. Cavity of tympanum none.

Family II. *Proteïdea.* External branchiæ persistent in most throughout the whole life. Eyes concealed under the skin, without eyelids, mostly small. Bodies of the vertebræ with conical excavations. Carpus (and tarsus) cartilaginous.

To the genera *Siren* L. and *Proteus*, which have three pairs of external gills, that continue to be the principal respiratory organs during the whole of life, *Amphiuma* and *Menopoma* succeed in natural order; they lose the gills indeed, but they retain a branchial aperture behind the head for the whole of life. That the giant salamander of Japan cannot be separated from *Menopoma* was pointed out by me at an earlier period, and is now generally acknowledged. At the same time this animal loses the gills and presents no branchial aperture. The sole character therefore of this division, otherwise so natural, is not to be sought in the persistence of the gills.

The *Proteïds*, from their *habitus*, fall into two natural groups. One of these contains *Siren*, *Proteus*, *Amphiuma;* the other group contains *Menopoma* or *Cryptobranchus* and *Sirenodon* (the *Axolotl*), and passes through the last, which perfectly resembles a larva of

Salamandra, to the following family. Compare on this group SPENCER F. BAIRD'S *Revision of the North American tailed Batrachia, Journal of the Acad. of Nat. Sc. of Philadelphia.* Sec. Series, I. 1850, pp. 281—294.

Phalanx I. *Anguinea.* Body elongate, round, with feet very short and slender, either four in number or two anterior only. Skin smooth. Tail compressed, two-edged, with adipose fin. Habit of snakes or scincs.

Siren L. Branchiæ persistent. Two very short feet, emergent from trunk behind the branchiæ, tetradactylous or tridactylous; hind feet none. Head obtuse; upper jaw produced beyond lower. Teeth subulate, crowded in palate.

Sp. *Siren lacertina* L., CUV. *R. Ani., éd. ill., Rept.* Pl. 42, fig. 2, ELLIS *Phil. Transact.* 1766, p. 189, Tab. IX. (reproduced in J. HUNTER'S *Observations on Anim. Œconomy, with notes by* R. OWEN, London, 1837, Pl. 52), ŒSTERDAM in LINN. *Amœn. Acad.*; from S. Carolina and attains a length of three feet; the feet have four toes. The siren feeds on worms and insects. The skeleton has about ninety vertebræ, eight pairs of short ribs, of which the first pair is affixed to the second vertebra, and no trace of pelvis. The three cartilaginous branchial arches are attached to an osseous tongue-bone. The lungs consist of two long sacs, of which the extremity is reflected forward. SCHNEIDER and other earlier writers regarded this animal as the larva of an unknown species of salamander, an opinion which cannot now be any longer maintained. See especially CUVIER in HUMBOLDT *Recueil d'Observ. de Zool.* &c. I. pp. 98—109, Pl. XI. XIV., and *Rech. sur les ossem. foss.* (Nouv. éd. 1824) V, I. pp. 417—426, Pl. 27.

Two other smaller species are known, *Siren intermedia* and *Siren striata*, both from North America; LECONTE *Annals of the Lyceum of Nat. Hist. of New York*, Vol. I. 1824, pp. 52—54, Pl. IV. Vol. II. p. 133, Pl. I.; *Siren striata* has only three fingers; see a figure by DUMÉR. and BIBRON, Pl. 96, fig. 1.

Hypochthon MERR., *Proteus* LAUR. Branchiæ persistent. Four short limbs, anterior tridactylous, posterior remote, didactylous. Teeth subulate in both jaws and in palate. Head triangular, narrowed towards the obtuse snout. Eyes very small.

Sp. *Hypochthon Laurentii* MERR., LAURENTI *Specim.* Tab. IV. fig. 3, p. 37, STURM *Deutschl. Fauna*, Abth. III. Heft 5, &c. This animal lives in certain caverns of Illyria and Dalmatia in subterranean waters, is of a pale flesh-colour with bright red gills, and attains a length of 11". Compare SCOPOLI *Annus quintus Historico-naturalis*, Lipsiæ, 1772, 8vo, p. 73; SCHREIBERS, *Philos. Transact.* 1801, 2, pp. 241—246, Pl. XVI. XVIII.; CUVIER in HUMB. *Recueil*, &c. I. pp. 117—122, Pl. XIII. figs. 5—10, and *Ossem. foss.* l. l. pp. 426—430, and especially the beautiful monograph of P. CONFIGLIACHI

and Rusconi *Del Proteo anguino di Laurenti*, Pavia, 1819, 4to. Constant local varieties occur in the different districts where this animal is found (or, as some think, different species), which are characterised by the form of the head and of the gills, and by the proportions of the body. See Fitzinger *Ueber den Proteus anguinus der Autoren, Sitzungsberichte der math. naturw. Classe der kaiserl. Akademie der Wissensch.* October, 1850. The most distinct of these is *Hypochthon xanthostictus* Fitz., of a dull purple colour, with yellow spots, and with large, widely extended, coarsely divided gills.

Amphiuma Garden, Harlan, Cuv. Branchiæ evanescent. Branchial apertures behind the head persistent. Four feet, didactylous or tridactylous. Teeth sharp, subulate in jaws and palate.

This genus, peculiar to North America, is very similar to the *Proteus* of Europe, but without permanent gills; though named as early as 1773 by Dr. Garden of *Charlestown*, in his correspondence with Ellis, it was first made generally known by the descriptions of the North-American zoologist Harlan, *Annals of the Lyceum of New York*, I. p. 269, and especially by those of Cuvier, *Mém. du Mus.* XIV. 1827, pp. 1—14, Pl. I. II. According to Tschudi, *Amphiuma means* Cuv. (with two fingers) is not specifically different from *Amphiuma tridactylum* Cuv. Comp. also a fig. of *Amphiuma tridactylum* in Cuv. *R. Ani., éd. ill., Reptiles*, Pl. 41, fig. 1.

Phalanx II. *Cordulina.* Body depressed, with four short legs. Skin in adults often rugose, warty. Habit of salamanders.

Menobranchus Harlan, *Necturus* Rafin., Fitz. Branchiæ persistent, broad, with short fringes, adhering to a depressed petiole. All the feet tetradactylous. Eyes small.

Sp. *Menobranchus lateralis* Harlan, *Proteus tetradactylus* Lac., *Ann. du Mus.* X. 1807, pp. 230—233, Pl. 17, Harlan *Ann. of the Lyceum of New York*, I. Pl. 16; Holbrook, *North American Herpetology*, Vol. III. Philadelphia, 1838, Pl. 30; Guérin, *Iconogr., Rept.*, Pl. 29, fig. 4, Cuv. *R. Ani., éd. ill., Rept.*, Pl. 41, fig. 2; North America, in lake Erie, the rivers Alleghany and Ohio. This animal appears to attain a length of 2′. One or two other species of this genus have been discovered in North America.

Cryptobranchus Leuck., Fitz., nob. *Menopoma* Harl., *Salamandrops* Wagl., (add *Megalobatrachus* Tschudi, *Sieboldia* Bonap.). Branchiæ evanescent. Head depressed, broad. Teeth in jaws and palate cylindrical, with apex subulate, in rows, crowded; palatine teeth arranged in a parallel row near the maxillary. Anterior feet tetradactylous, posterior pentadactylous. Skin plicate, undulate, loose at the sides of body.

Sp. *Cryptobranchus Alleghaniensis* nob., *Salamandra gigantea* Barton, Cuv. *R. Ani., éd. ill., Rept.*, Pl. 41 *bis.* fig. 1, Barton *Memoir concerning an*

Animal of the class Reptilia, which is known in the United States by the names of Alligator and Hell-bender. Philadelphia, 1812, 8vo, with fig. (copied in GRIFFITH'S *Animal Kingdom*, IX. p. 475); a permanent gill-aperture behind the head, in front of five legs. This animal is met with in many rivers of N. America, and attains a length of 18", or, as has been asserted, even of 2'. It is named *Tweeg* by the Delaware Indians. HOLBROOK, in his *North American Herpetology*, in 1842, made known another species, *Menopoma fuscum*, V. Pl. 33, from the west of S. Carolina.

Cryptobranchus japonicus nob., *Salamandra maxima* SCHLEG., *Megalobatrachus Sieboldii* TSCHUDI, *Tritomegas Sieboldii* DUM. and BIBR., SCHLEG. *Faun. Japon., Rept.* Tab. VI.—VIII.; in this species, which becomes more than 3 feet long, there is no gill-aperture present, or rather it has early disappeared. It is the largest of all the known naked Amphibia, and is not distinguished from *Menopoma* by any single generic character. Compare my article in the *Tijdschr. voor nat. Gesch.* V. pp. 375—386, and in the *Mém. de la Soc. d'Hist. nat. de Strasbourg*, 1840, III. *Fragmens zoologiques sur les Batraciens*, pp. 7—11. To the same genus also belongs the extinct species met with in the tertiary fresh-water formations of *Œningen*, of which the remains were formerly regarded as fossil human bones. SCHEUCHZER'S *Homo diluvii testis, Philos. Transact.* 1726, p. 38, CUVIER *Ann. du Mus.* XIII. pp. 411—420, Pl. 30, figs. 2, 3, and *Rech. sur les oss. foss.; Andrias Scheuchzeri* TSCHUDI, *Class. d. Batr.* Tab. 3—5. This species might be named *Cryptobranchus primigenius.*

Siredon WAGL., FITZINGER (*Axolotl* CUV., *Axolotes* OWEN). Branchiæ persistent, large, with peduncle subulate and long, filiform fringes. Eyes moderate. Lower jaw slightly produced in front of upper. Anterior feet tetradactylous, posterior pentadactylous.

Sp. *Siredon mexicanum, Siredon axolotl* WAGL., CUV., in HUMB. *Recueil d'Observ. de Zool.* I. Pl. XII., HOME *Phil. Trans.*, 1824, I. p. 419, Tab. 21—23, DUMÉR. *et* BIBR. *Rept.* Pl. 95; this species becomes 14" long, and perfectly resembles a larva of *Salamandra* or *Triton.*

Family III. *Salamandrina.* Respiration in the perfect state solely pulmonal; external branchiæ in larvæ. Eyes with distinct eyelids, moderate. Four feet, with carpus and tarsus osseous in most; anterior tetradactylous, posterior almost always pentadactylous.

Salamandra SCHN. (*Salamandra* and *Triton* LAURENTI). Characters of the family.

SCHNEIDER has reunited the water-salamanders with the land-salamanders, which LAURENTI had separated from them under the generic name of *Triton;* see his *Hist. Amphibior. natur. et litter.*

Fasc. I. pp. 1—5. These animals form a family belonging to the northern hemisphere, of which different species occur in Europe and in Japan, but which are especially numerous in North America. The larvæ live constantly in water, even of those species which, in the adult state, keep on land. The external gills persist until the development of the pulmonal respiration, when with the gill-apertures they entirely disappear. In the larvæ the fore limbs are developed earlier than the hinder. The animals of this class may be termed small, at least all of them continue far below most of the species of the preceding family.

Compare J. P. WURFFBAINII *Salamandrologia, h. e. Descriptio historico-philologico-philosophico-medica Salamandræ.* Norimbergiæ, 1683;—P. A. LATREILLE *Hist. nat. des Salamandres de France, avec figs. color.* Paris, 1800, 8vo;—RUSCONI *Descrizione anatomica degli organi della circulazione delle larve delle Salamandre aquatiche;* fig. Pavia, 1847, 4to; M. RUSCONI *Hist., devéloppement et métamorphose de la Salamandre terrestre. Ouvrage posthume publié par le* Doct. JOS. MORGANTI. Av. 6 pl. Pavie, 1854, 4to; and by the same, *Amours des Salamandres aquatiques.* Milan, 1821, fol. avec figs.;—C. TH. E. DE SIEBOLD *Observationes quædam de Salamandris et Tritonibus. Accedit Tabula æn.* Berolini, 1828, 4to;—J. L. C. GRAVENHORST *Reptilia Musei Zoologici Vratislaviensis,* I. Lipsiæ, 1829, fol. pp. 73—88, pp. 91—104;—TSCHUDI l. l. pp. 56—61, 91—95.

† *With tail compressed throughout or towards the extremity.*

Triton LAURENTI, WAGL., *Molge* MERR.

Sp. *Salamandra cristata* SCHNEID., *Lacerta palustris* L., BECHST. in LAC. *Germ. translat.* II. Tab. XIX., LATR. *Salam. de Fr.* Pl. III. fig. 3, STURM *Deutschl. Fauna, Amphib.* Heft 3, TH. BELL *History of British Rept.* London, 1849, pp. 129—139; skin uneven, warty; this species attains a length of 6″, and is the largest water-salamander in Europe; the upper lip hangs over the margin of the lower jaw; the male has in summer a membranous crest on the back which is divided into slips and is distinct from a similar crest on the tail. SCHLEGEL refers also to this species *Triton alpestris* and *carnifex* of LAURENTI.—*Salamandra punctata* LATR., *Salam. tæniata* SCHNEID., BECHST. l. l. Tab. XXI., LATR. l. c. Pl. VI. fig. 6, STURM l. c. Heft 5, BELL l. c. pp. 143—153; smaller than the preceding, the skin smooth, the membranous crest on the back continuous with that on the tail, &c.

In the water-salamanders the eggs are impregnated before being laid. The female deposits her eggs on aquatic plants, and folds every leaf to which she has attached an egg in such a way that its under surface is turned inwards, the plait or fold being caused to stick

together by the gelatinous covering of the egg[1]. The European species usually lose their gills as early as the third month; but if they have not lost them on the approach of winter, they retain them the winter through, and themselves continue to grow. They are capable of propagating not before the third year, as has been noted of our frogs. The larvæ feed on aquatic insects, molluscs and worms, as do the adult animals. Many species in the adult state live both on land and in water.

Of the exotic species we mention only the *Salamandra unguiculata* SCHLEG., *Salamandra japonica* HOUTT., SCHNEID., which in the state of larva and at the period of pairing has nails, a fact not observed in any other Salamander or Proteïd. HOUTTUYN *Verh. van het Zeeuwsch Genootschap der Wetensch.* IX. 1782, p. 329, fig. 3 opposite p. 336, and SCHLEG. *Faun. Jap., Rept., Saur. et Batrach.* Tab. 5, figs. 1—5. TSCHUDI forms from this species his genus *Onychodactylus*. In some species from North America, besides the usual teeth on the palate (in the vomer), there are also teeth on the inferior surface of the sphænoïd bone, set close together, as in a card. To such belong the genera *Hemidactylium, Plethodon* and *Cylindrosoma* of TSCHUDI (*Spelerpes* RAFIN.). *Hemidactylium, Desmodactylus* DUM., BIBR., like *Salamandrina* FITZING. has only four toes on the hind feet; to *Salamandrina* belongs *Salamandra perspicillata* SAVI, BONAP. *Fauna Italic. Amfibi*, Tab. 84, fig. 8. (Of this *Sal. tridactyla* LAC. II. Pl. 36, is an imperfectly preserved specimen.) The sub-genus *Pleurodeles* MICHAHELLES, OKEN'S *Isis*, 1830, s. 191—195, differs by the larger development of the ribs, of which the points are visible at the side through the skin, TSCHUDI l. l. Tab. 2, fig. 1, SCHLEG. *Abbild.* Tab. 39, figs. 2, 3. Compare on other sub-genera TSCHUDI l. l. and SPENCER BAIRD, *Revision of the North American tailed Batrachia, Journal of the Acad. of nat. Sciences of Philadelphia.* Sec. Series, Vol. I. 1849, pp. 281—294.

†† *With tail round, fusiform.*

Salamandra LAURENTI, MERR. Head with a glandular, porous tuber on each side behind the eyes. Anterior feet with four toes, posterior with five toes.

Sp. *Salamandra maculata* MERR., *Lacerta Salamandra* L., LATR. *Salam. de Fr.* Pl. I., STURM *Deutschl. Fauna, Amph.* Heft II., A. F. FUNK *De Salamandræ terrestris vita, evolutione, formatione; cum tabulis æn.* Berolini, 1827, folio; yellow with black spots, or black with yellow spots; sometimes almost entirely black. Different however from this black variety is

[1] Such was the account given by BECHSTEIN in his translation of LACEPÈDE, *Naturgesch. der Amphibien* 2, s. 235, with which the observations of RUSCONI entirely agree, *Amours des Sal. aquat.* pp. 21, 22, Pl. II. fig. 2. SPALLANZANI had said that the eggs are laid adhering together in long strings; this has been repeated by later writers, to whom the observations of RUSCONI might have been known.

Sal. altra LAUR., *Syn. Rept.* Tab. I. fig. 2, STURM *Deutschl. Faun.*, which lives on high mountains. Both species are viviparous, but the last brings forth only two young ones at a time, the first a much larger number, twenty-four and more. See my *Fragm. Zool. s. l. Batrac., Mém. de la Soc. d' Hist. nat. de Strasb.* III. The genus of the Land-salamanders appears to be limited to these two European species.

Order III. *Batrachii* s. *Miura.*

Legs four. Tail in adults none. Lower jaw edentulous. Cavity of tympanum with an Eustachian tube nearly in all. Respiration in the larvæ branchial, with branchiæ external at first, afterwards internal.

Family IV. *Batrachii.* (Characters of the order those of the single family. Skin naked, smooth. Anterior feet with four toes, posterior with five. *Rana* L.).

All are oviparous. The larvæ of these animals breathe by internal gills; during the first period of time external gills also are present, as in the larvæ of salamanders; these gills have the form of finger-shaped tubes, and are divided into two, three or more lobes. They disappear a few days after birth, and then the internal gills alone remain, which are attached to four pairs of cartilaginous branchial arches connected with the tongue-bone; they consist of small crests divided into numerous branches, and continue rudimentary on the last branchial arch, whilst on the first they are arranged in a single, on the second in a double row. After the disappearance of the gills, the tongue-bone also alters its form, loses its branchial arches, and becomes flatter. The larvæ, which at first have no limbs, shew their hind legs first; the tail, very large in some, disappears slowly by resorption, which proceeds from the point to the base.

Compare RUSCONI *Developpement de la Grenouille commune,* avec 4 pl. color. Milan, 1826, 4to; MARTIN ST. ANGE *Recherches anat. et physiol. sur les organes transitoires et la Métamorphose des Batraciens, Ann. des Sc. nat.* Tom. 24, 1831, pp. 366, 408—418; RATHKE *Untersuchungen über den Kiemen-Apparat u. das Zungenbein,* 1832, 4to; LEREBOULLET *Anat. comp. de l'appareil respiratoire dans les animaux vertébrés.* Paris et Strasbourg, 1831, 4to, pp. 104, 111, 112.

Two chief works on this family are, RŒSEL *Historia naturalis Ranarum nostratium,* Norimb. 1758, folio, with excellent coloured figures, and F. M. DAUDIN *Histoire naturelle des Rainettes, des Grenouilles et des Crapauds.* Avec 38 planches. Paris, XI. (1803).

By modern writers, especially by WAGLER and TSCHUDI, a great number of genera have been adopted which replace the genus *Rana* of Linnæus. The greater part however of these divisions can only be noticed as sub-genera. That these animals moreover represent the chelonians amongst the *diplopnoa* is obvious, especially from the *habitus* of certain toads; and it is remarkable that in some of them a dorsal shield, however rudimentary, may be observed.

A. *Tongue none.*

Pipa LAUR., MERR., DUM. and BIBR., *Asterodactylus* WAGL. Body broad, depressed. Head broad, anteriorly acuminate, trigonal. Eyes very small in the margin of jaw. Teeth none. Anterior toes slender, with the last joint quadrifid.

Sp. *Pipa americana* LAUR., *Rana Pipa* L., SEBA *Thesaur.* I. Tab. 77, DAUD. *Rain., Gren. et Crap.* Pl. 31, 32, fig. 2, BLUMENB. *Abbildung. naturhistor. Gegenst.* No. 36; in Surinam and Brasil. The development of the young takes place on the back of the mother; the male places there the impregnated eggs; there are small cavities, or nearly hexangular cells, in which the eggs are received. Here the young pipas undergo their change, and do not quit the cells before they have lost their tail. See FERMIN'S *Abhandlungen von den Surinamischen Kröte oder Pipa, übersetzt von* J. A. GŒZE. Mit 4 Kupfert. Braunschweig, 1776; F. G. BREYER, *Observationes anatomicæ circa fabricam Ranæ Pipæ.* Cum Tab. 2 æn. Berolini, 1811; C. MAYER, *Beiträge zu einer anatomischen Monographie der Rana Pipa, Nov. Act. Acad. Cæsar. Leop. Car.* Vol. XII. p. 2. Only one species of this genus is known hitherto.

Xenopus WAGL., *Dactylethra* CUV., DUM. and BIBR. Teeth in upper jaw. Anterior legs small, slender, with toes subulate, thin, subequal; posterior large, with soles palmate, three inner toes unguiculate. Head short, with eyes moderate.

Of this genus also only one species is known hitherto, *Xenopus Bojei* WAGL.; *Dactylethra capensis* CUV., DUM. and BIBR., CUV. *R. Ani.*, sec. éd., Pl. 7, fig. 3, C. MAYER *Analecten f. vergl. Anat.* 1835, Tab. II. figs. 5, 6, pp. 29—35, *Dactylethra Delalandii* CUV. *R. Ani., éd. ill., Rept.* Pl. 38, fig. 2, at the Cape of Good Hope and the coast of Mozambique.

Like *Salamandra unguiculata* in the preceding family, *Xenopus* amongst the frogs is the only example of the presence of claws, which occur nowhere else amongst the *Diplopnoa*. The skeleton of *Xenopus* has much resemblance to that of *Pipa*, especially in the pelvis; the transverse processes of the sacrum are triangular plates, with the apex turned inwards, which afford a broad attachment for the iliac bones. In *Pipa* and *Xenopus* the two Eustachian tubes terminate in a small common opening in the middle of the ridge behind the palate. The membrane of the tympanum is cartilaginous.

Myobatrachus SCHLEG. (Is this its place?)

Note.—A genus imperfectly known from a single specimen, not very well preserved. Two subulate teeth in palate (vomer); no maxillary teeth. No tongue seems to be present. Feet short, immersed in trunk.

Sp. *Myobatrachus paradoxus* SCHL. *Mus. L. B.* from New Holland.

B. *Tongue distinct.*

a) *Teeth in upper jaw.*

† *Points of toes not expanded.*

Bombinator MERR. (in part), DUGÈS. Cavity of tympanum none. No glandular tuberosities behind eyes. Tongue orbicular, affixed on all sides.

Sp. *Bombinator igneus* MERR. *Rana Bombina* L., *Bufo bombinus* DAUD., RŒSEL *Ran.* Tab. 22, 23, CUVIER *R. Ani., éd. ill., Rept.* Pl. 39, fig. 1; a small species, dirty brown above, below yellow or orange-coloured with irregular blue-black spots.—*Bombinator fuscus* FITZING., *Bufo fuscus* LAUR., *Pelobates fuscus* WAGL., DUM. *et* BIBR., RŒS. *Ran.* Tab. 17—19, CUV. *R. Ani., éd. ill, Rept.* Pl. 38, fig. 1; this species diffuses an odour resembling garlick; the larvæ retain the tail a long time, until they are already very large, much like the *Rana paradoxa* of Surinam; see below, pp. 250, 251. The granular uneven surface of the cranial bones also is peculiar in this species. The hind legs present on the inside of the *tarsus* a flat, sharp-edged process, covered with hard horny skin; here also belongs a species from the south of France and Spain, named by CUVIER *Rana cultripes* (*Cultripes provincialis* MUELL., *Pelobates cultripes* TSCHUDI). The transverse processes of the sacrum are triangular plates, broad at their extremity, as in the two preceding genera.

Alytes WAGL. (Spec. of *Bombinator* MERR.). Membrane of tympanum distinct. Glandular tuberosities above tympanum. Tongue orbicular, affixed on all sides. Toes of posterior feet joined by membrane at their base alone.

Sp. *Alytes obstetricans* WAGL., *Bufo obstetricans* LAUR., BRONGNIART *Essai*, &c., fig. 9, STURM *Deutschl. Fauna, Amphib.* Heft 4. This small species, which is found in France and Southern Germany, Switzerland and Italy, produces a shrill sound, like that of a bell (the true *Rana campisona* of GESNER, which LINNÆUS confounded with *Rana bombina*). It is still more celebrated for the assistance which the male affords the female when laying her eggs, which causes them to adhere to his hind legs by small pedicles. The eggs have a yellow colour; they remain attached to the male, until the embryo is sufficiently developed; then he leaves his place of concealment underground and betakes himself to the water; except at this

time the adult animals appear to live constantly on land and also to copulate there[1]. The development of this species has been investigated by C. VOGT; see above, p. 226.—*Alytes punctatus* TSCHUDI, *Pelobates punctatus* FITZ., *Bonap. Faun. Italica, Amfib.*

Note.—Here should be referred sub-genus *Scaphiopus* HOLBROOK, approaching very nearly to *Alytes* by several characters, agreeing with *Pelobates* in the spatulate process to the tarsus.

Sp. *Scaphiopus solitarius* HOLBROOK, *North American Herpetology.* Philadelphia, 1836, Vol. I. Pl. 12.

Ceratophrys BOIE, SCHLEG. Membrane of tympanum naked in some, in others hidden under the skin. Anterior feet cloven, posterior semipalmate. Head large. Eyelids protracted above the eye into a conical process. Tongue orbicular, free behind, entire or emarginate.

Megalophrys KUHL, *Ceratophrys* GRAVENH. Head depressed; membrane of tympanum small, little distinct. Teeth of upper jaw thin, setaceous. Skin of back smooth. Posterior extremities elongate. (Habit of Frogs.)

Sp. *Ceratophrys montana* GRAVENH., *Megalophrys montana* KUHL, *Mus. L. B.*, SCHLEG. *Abbild.* Tab. X. fig. 3; on the Island of Java.

Ceratophrys BOIE, DUM. and BIBR., *Stombus* GRAV. Head very large, with gape of mouth very ample. Teeth subulate, somewhat large. Membrane of tympanum distinct, covered slightly or not at all. Skin of back tuberculate. Posterior limbs moderate. (Habit of Frogs.)

Sp. *Ceratophrys cornuta* SCHL. (in part), *Rana cornuta* L., *Ceratophrys dorsata* MAXIM., *Prinz. v.* NEUW. *Abb. z. Naturgesch. Brasil.*, Lief. XI. male, Lief. X. fem. SCHLEG. *Abbild.* Tab. X. figs. 1, 2. One of the largest species of this family; the skin of the back contains bony laminæ. The skeleton of this species is figured in C. G. KLŒTZKE (*præs.* RUDOLPHI) *Diss. anat. de Rana cornuta,* Berolini, 1816, 4to; *Ceratophrys Boiei* MAX., GRAVENH. *Rept. Mus. Vratisl.* Tab. IX. figs. 1, 2, GUÉRIN. *Iconogr., Rept.* Pl. 26, fig. 2. &c. These animals inhabit the forests of South America.

Asterophrys TSCHUDI. Membrane of tympanum naked. Tongue oblongo-orbicular, posteriorly entire, thin. Feet with cloven toes.

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[1] This peculiarity in the mode of life of this species of frog or toad was first observed by DEMOURS *Mém. de l'Acad. royale des Sciences de Paris p. l'année* 1741, p. 13.

Transverse, convex row of conical papillæ in palate. (Upper eyelid with a conical tubercle and some small conical warts.)

Sp. *Ceratophrys turpicola* (*sic!* is it for *turpicula?*) MUELL., SCHLEG. *Abb.* Tab. X. fig. 4; New Guinea.

Note.—*Rana scutata* SPIX, genus *Hemiphractus* WAGL., is unknown to me. Teeth are described in the lower jaw, an instance, if there be no error, which is unique in the *Miura*.

Pyxicephalus TSCHUDI, DUM. and BIBR. Head broad, short, gibbous above. Membrane of tympanum mostly distinct. Teeth subulate, somewhat large. Bones of cranium rough, granular above. Anterior feet cloven, posterior semipalmate; with a flat, sharp spur in the sole, at the inner margin of first toe. Tongue oval, free posteriorly, bilobed. Trunk short, broad.

Sp. *Pyxicephalus Delalandii* TSCHUDI, DUM. and BIBR. *Rept.* Pl. 87, fig. 1, South Africa.

Discoglossus OTTH, DUM. and BIBR. Head flat, continuous with trunk. Membrane of tympanum concealed. Anterior feet cloven, posterior semipalmate. Tongue free posteriorly, rotundato-trigonal or suborbicular.

Sp. *Discoglossus pictus* OTTH, BONAP. *Faun. Italica, Amfibi,* Fasc. XXIV. Sicily, Sardinia, Greece.

Cystignathus WAGL., DUM. and BIBR. Membrane of tympanum distinct, or scarcely visible. Anterior feet cloven, posterior semipalmate, or cloven, with slender toes. Subgular vocal sac in males or two lateral sacs. Tongue large, orbicular, free posteriorly, entire or emarginate.

Sp. *Cystignathus ocellatus, Rana ocellata* L. (in part), SEBA *Thes.* I. Tab. 75, fig. 1, DAUD. *Rain., Gren. et Crap.* Pl. 19, *Rana pachypus, Rana sibilatrix* MAXIM. *Pr. zu Wied.* South America, West Indies; one of the largest species of this family. Almost all the species of this genus are from America.

Pseudis WAGL., DUM. and BIBR. Membrane of tympanum scarcely distinct. Anterior feet cloven, with first toe capable of opposing the others like a thumb; posterior feet palmate, with membrane ample. Gular vocal sac in males. Tongue orbicular, entire, connate with chin, free at the margin only.

Sp. *Pseudis paradoxa* TSCHUDI, *Rana paradoxa* L., MERIAN *Ins. Surinam.* Tab. 71, SEBA *Thesaur.* Tab. 78, figs. 15—21 (not all the figures, as

LINNÆUS quotes them). This species retains the tail very long, and is smaller when adult than before the loss of the tail; hence MERIAN and SEBA fell into the mistake that it undergoes a retrograde metamorphosis into a fish; it is met with in Surinam.

Rana L. (exclusive of many species). Membrane of tympanum distinct. Anterior feet cloven, posterior palmate. Tongue oblong, posteriorly deeply emarginate, free, exsertile. Two lateral vocal sacs in males, emerging externally in some when distended with air.

Sp. *Rana esculenta* L., RŒSEL *Hist. Ranar.* Tab. 13—16; STURM *Deutschl. Faun., Amphib.* Heft 1., DAUD. *Rain., Gren. et Crap.* Pl. 15, fig. 1, BELL *Hist. Brit. Rept.* sec. ed. London, 1849, p. 110; *the green frog, der grüne Wasserfrosch;* green above, with black spots, under-surface of body whitish; the vocal sacs in this species become visible externally (see above, p. 221). The croak, very loud and especially by night, is heard at a great distance. This species is very common in Holland, but in England is confined to particular localities.—*Rana temporaria* L., RŒSEL l. l. TAB. I.—VIII. STURM l. l. DAUD. Pl. 13, fig. 2, BELL l. l. p. 89; *the brown frog;* yellow-brown or reddish; a dark brown longitudinal spot behind the eyes, which passes obliquely over the membrane of tympanum and ends in a point backwards. In this species the vocal sacs do not pass out externally. *Rana temporaria* contains, according to STEENSTRUP, two species, *oxyrhinus* and *platyrhinus*. The last is the most common (*Bericht der 24te Versamml. der deutschen Naturforscher, in Kiel.*). See also THOMAS *Ann. des Sc. nat.* 4ième série, Tom. IV. 1855, p. 365. These animals make only a growling sound, especially when uneasy and in pairing time; at this time only do they live in water, at other times they keep on land. A very large species of this genus occurs in the East Indies, *Rana cutipora* DUM. and BIBR., *Rana saparuæ* REINW. M. S., *Dactylethra benghalensis!* LESSON *Illustr. de Zool.* Pl. 47, and one still larger in North America, *Rana mugiens* MERR., *the Bull-frog* of CATESBY. Most of the species of the genus *Rana* of modern writers are from the eastern hemisphere.

On some other sub-genera, here omitted, cons. DUMERIL and BIBRON l. l. Vol. VIII. In habit, and especially in the small and slender fore feet, *Leptobrachium* TSCHUDI differs from the rest of the *Ranæ*.

Sp. *Rana Hasseltii* Mus. L. B.; head broad, depressed; back obscurely fuscous, with black spots. Hab. in Java.

†† *Apices of fingers and toes dilated orbiculately.*

Hyla LAUR., FITZINGER and others, *Calamita* SCHN., MERR.

The *tree-frogs, Rainettes, Laubfrosche.* These frogs live on trees and climb with ease, like the Geckos amongst the Saurians. The

adhesion is effected by appression of the dilated extremities of their fingers and toes and by a viscosity; see v. WITTICH *Der Mechanismus der Haftzehen von Hyla arborea*, MULLER'S *Archiv*, 1854, s. 170—183, Pl. viii. figs. 2, 3. The species are very numerous, but, with the exception of a single one, foreign to our quarter of the world; more than half of those now known are natives of the new world. The skin is mostly smooth on the back, whilst on the abdominal surface and along the inside of the legs it is beset with small tubercles or warts placed close together. The colours are often lively and are also variable. *Hyla viridis* has two kinds of pigment-cells beneath the skin which are essentially different, and one of them consists of two subdivisions. The one kind is irregularly polyhedral and filled with gold-yellow pigment-granules. They never change their form. The cells of the other kind are starred or polyhedral of variable form; one class of these is black, the other light brown. The difference of colour depends upon the mass of the contained pigment-molecules, which singly are light brown. The brown pigment-cells exhibit interference-colours that belong to the third Newtonian system of rings. The black pigment-cells shew here and there a shade of blue. The yellow pigment-cells are placed the deepest below the cuticle. The brown pigment-cells in particular places have long anastomosing processes, and under different circumstances of excitement the pigment-granules are caused to pass from the processes, which then contain only a fluid on which the interference-colours depend. Thus the change of colour arises from the variable quantity of the brown molecules in the more superficial layer of cells, which on the one hand allows of a greater or less transparency for the yellow cells below them to be seen, and on the other a quantity of fluid, more or less unmixed with pigment-molecules, for the production of the interference-colours. See HARLESS *Ueber die Chromatophoren des Frosches, Zeitschr. f. wissensch. Zool.* v. 1854, pp. 373—379. For the skin of *Rana temporaria* see A. HENSCHE *Ueber die Drusen und glatten Muskeln in deraussern Haut von Rana temporaria, Zeitschr. f. wissensch. Zool.* VII. 1855, 273—282.

On this genus see A. DUMÉRIL *Mém. sur les Batraciens anoures de la Famille des Hylæformes ou Rainettes, Ann. des sc. nat.* 3ième série, XIX. 1853, p. 135—179.

* *With membrane of tympanum covered, latent.*

Microhyla TSCHUDI.

Theloderma TSCHUDI.

Notodelphys LICHTENST. and WEINLAND.

See WEINLAND *Ueber den Beutelfrosch*, in MUELLER'S *Archiv*, 1854, s. 449—477, Taf. XVII—XIX. A fissure in the dorsal integument of the female leads to two lateral pouches for the reception of the eggs. Similar seems to be the disposition in *Hyla marsupiata* DUM. and BIBR., apparently a distinct species of the true *Hyla* division.

** *With membrane of tympanum distinct.*

a) *With palms and soles palmate, ample.*

Racophorus KUHL, TSCHUDI, *Hypsiboas* WAGL. Tongue oblong, posteriorly free, forked. Teeth in vomerine bones in a transverse row, interrupted in the middle. Trunk posteriorly narrow, slender. Posterior feet long.

Hyla Reinwardtii SCHLEG. *Abbild.* Tab. 30, in the East Indies.

β) *With palms cloven or semipalmate, with soles semipalmate or palmate.*

1) *With palatine teeth none.*

Eucnemis TSCHUDI, DUM. and BIBR. (and *Orchestes* TSCHUDI, *Ixalus* DUM. and BIBR.).

2) *With palatine teeth.*

Hyla TSCHUDI, DUM. and BIBR. Tongue orbicular, adnate, or posteriorly subfree. Anterior feet mostly cloven, posterior semipalmate.

Sp. *Hyla viridis* LAUR., *Rana arborea* L., ROESEL *Hist. Ran.* Tab. 9—12, STURM *Deutschl. Fauna, Amphib.* Heft 1; the *tree-frog;* the males have a sac beneath the throat which, when they cry, is dilated.

Polypedates TSCHUDI.

Limnodytes DUM. and BIBR. (Tongue in these genera posteriorly free, furcate.)

Litoria TSCHUDI, DUM. and BIBR., *Acris* DUM. and BIBR. Tongue discoïd or cordate, posteriorly free. Points of fingers with discs small.

γ) *With palms and soles cloven.*

Hylodes FITZ. (add *Phyllomedusa* WAGL.). Teeth in palate.

Sp. *Hyla bicolor, Rana bicolor* BODD., GMEL., DAUD. *Rain., Gren. et Crap.* Pl. 5, 6, GUÉRIN *Iconogr., Rept.* Pl. 26, fig. 3; South America.

Crossodactylus DUM. and BIBR., and *Phyllobates* eorund. Palatine teeth none.

b) *Upper jaw edentulous.*

† *Apices of fingers and toes dilated orbicularly.*

Dendrobates TSCHUDI (*Hylaplesia* BOIE in part). Tongue oblong, posteriorly free. Teeth in palate none. Glandular tuberosities at the sides of head none. Membrane of tympanum naked. Fingers and toes cloven.

Sp. *Dendrobates tinctorius* WAGL., *Hyla tinctoria* DAUD., *Rain. Gren. Crap.* Pl. 8, DUM. *et* BIBR. *Rept.* Pl. 90, fig. 1; South America. The habitus is entirely that of *Hyla.*

Hylædactylus DUM. and BIBR. (*Hyladactyla* TSCHUDI). Tongue large, adnate, free at the margin only. Palatine teeth. No glandular tuberosities at the sides of head. Membrane of tympanum latent. Head depressed, immersed in trunk. Body broad, feet short. Fingers cloven, toes semipalmate.

Sp. *Hylædactylus baleatus, Bombinator baleatus* (? sic) MUELL.; Java.

†† *Apices of fingers and toes not expanded.*

* *Membrane of Tympanum distinct.*

Bufo LAUR., MERR. (excl. of some species). Teeth none. Tongue oblong, oval, free posteriorly. Anterior limbs tetradactylous, cloven, posterior pentadactylous, mostly semipalmate. Tuberosity on both sides behind the eyes, above the tympanum, porous, cushioned.

Toads.—This genus contains nocturnal animals which hide themselves during day-light. Two cushion-shaped groups of glands occur here, as in the salamanders, improperly named *parotids* in descriptive zoology. The head is obtuse in front; the upper jaw descends directly downwards, so that the intermaxillary bones do not project in front of the cranium. A similar form of the upper jaw occurs in most of the *Hylæ*, whilst in the frogs (*Ranæ*) it is very flat and runs into a sharp edge, so that the intermaxillary bones lie nearly horizontal in front of the cranium.

Sp. *Bufo vulgaris* LAUR., *Rana bufo* (and *Rana rubeta*) L., ROESEL *Ran.* Tab. 20, 21, STURM *Deutschl. Fauna, Amphib.* Heft 1. (figures of ROESEL), GUÉRIN *Iconogr., Rept.* Pl. 27, fig. 1, BELL *Brit. Rept.* p. 115; usually grey-brown, a black stripe externally along the parotids.—*Bufo viridis* DUM. and BIBR. (*Bufo calamita* and *Bufo viridis* LAUR., *Rana portentosa* BLUMENB., *Bufo variabilis* PALL.), ROES. *Ran.* Tab. 21, STURM l. l. DAUD. *Rain., Gren. et Crap.* Pl. 28, figs. 1, 2; smaller than the preceding;

a yellow-green iris, which in the preceding species is red or gold-coloured; often a yellow stripe along the middle of the back.—*Bufo marinus* GRAV., *Rana marina* L., *Bufo agua* DAUD. et alior., SEBA *Thesaur.* I. Tab. 76, fig. 1, DAUD. *Rain., Gren. et Crap.* Pl. 36, 37, MAX. NEUW. *Abb. zur Naturgesch. Bras.*; the largest species of toad, 10″—12″ without the legs; in different parts of South America. *Bufo margaritifer* DAUD., *Rana typhonia* L., DAUD. l. l. Pl. 33, fig. 1, MAX. NEUW. *Abb. z. Naturg. Bras.* (under the name of *Bufo oxyrhynchus*) also from South America; on each side of the head above the orbit runs a bony ridge; the cranium is excavated above. CUVIER forms from this species his sub-genus *Otilophus*.

** *Membrane of Tympanum concealed.*

Lateral tuberosities behind the eyes none.

Uperodon DUM. and BIBR. Palatine teeth. Head small, rounded. Gape of mouth narrow. Tongue adnate, free at the margin, orbicular, large.

Sp. *Uperodon marmoratus, Engystoma marmoratum* CUV., GUÉRIN *Iconogr., Rept.* Pl. 27, fig. 3. Bengal.

Phryniscus WIEGM. Palatine teeth none. Tongue oblong, free posteriorly.

Sp. *Phryniscus nigricans* WIEGM. Monte Video.

Brachycephalus FITZ., *Ephippifer* COCTEAU.

Microps WAGL., FITZ. (previously *Engystoma* FITZ., in part), *Stenocephalus* TSCHUDI. Palatine teeth none. Eyes small. Head small, anteriorly acute, triangular. Gape of mouth small.

Sp. *Microps ovalis* nob., *Rana ovalis* SCHN., *Microps unicolor* WAGL., *Engystoma ovale* DUM. and BIBR., DAUD. l. l. Pl. 33, fig. 2, GUÉRIN *Iconog., Rept.* Pl. 27, fig. 2; a very small species from South America.

Breviceps MERR., *Systoma* WAGL. Palatine teeth none. Head continuous with trunk, very short, truncate; gape of mouth very narrow. Feet short, immersed at the base in trunk. Body gibbous.

Breviceps gibbosus MERREM, *Rana gibbosa* L., LACEP. I. Pl. 40, DAUD. l. l., Pl. 29, fig. 2, Pl. 35, fig. 2, in South America.

Note.—On some other sub-genera, omitted here, comp. DUMÉR. *et* BIBRON, VIII. pp. 640—760.

SECTION II. *Reptilia haplopnoa.* (*Monopnoa* FITZING., *Philodota* MERR.).

Branchiæ neither persistent nor deciduous. Respiration solely pulmonal. Body covered with scaly skin or loricate with scutes. Occipital condyle mostly single under the *foramen magnum* for articulation with the first vertebra. Labyrinth in addition to the *fenestra* of the vestibule also furnished with a *fenestra rotunda* and a rudiment of a cochlea.

ORDER IV. *Ophidii.*

Cavity of tympanum none. Eyes covered with eyelid, single, immobile, pellucid. (Feet mostly none; vestiges of hind feet in some; in a single genus two anterior very short feet, in the rest no vestiges of sternum and shoulder-bones.)

The most obvious character of the serpents is the entire absence of limbs. But if this character were relied on exclusively to determine whether an animal of this class belonged to the serpents, the *Cæciliæ* (see above p. 238) also would have to be referred to it. Hence it is necessary to have recourse for a basis to the anatomical characters first brought forward by J. MUELLER (*Zeitschr. für Physiologie, herausgegeben* von TIEDEMANN u. TREVIRANUS, IV. 2, 1832, s. 222—240), and to refer the genera *Anguis, Acontias,* and *Ophisaurus,* notwithstanding the absence of limbs, to the lacertine animals. In this way the genus *Chirotes,* although it possesses anterior limbs and vestiges of a sternum, is not separated from *Amphisbæna,* but is placed in the order of the serpents; the *Amphisbænæ* themselves having vestiges of a scapula. (See RATHKE *Ueber den Bau und die Entwickelung des Brustbeins der Saurier.*) The eye-ball, constantly covered by an immoveable transparent eye-lid, is thus a chief character of this order.

Whilst anterior limbs are met with in *Chirotes* alone, in many genera imperfect posterior limbs occur. Internally there is found, close to the tail, yet not united with the vertebral column but at some distance from it, an elongated little bone on each side, which ends below in an articular head by which two small bones that diverge from each other, the one directed downwards the other inwards, are connected. Between the two is situated a somewhat larger bone curved in form of the letter *S*, as a phalangeal bone which supports a

conical nail. These nails or spurs (*calcaria*) are observed, near the *anus*, in front of the commencement of the tail, in the genera *Boa*, *Python*, *Eryx* and *Tortrix*. This bony apparatus is moved by its own proper muscles. In other serpents there is only the first elongated bone present beneath the skin, as in *Amphisbæna* and *Typhlops*. In most serpents this apparatus is wanting altogether. See MAYER *Ueber die hintere Extremität der Ophidier*, *Nov. Act. Acad. Cæs. Leop. Carol.* Tom. XII. p. 818 and foll.

Through the absence of feet the serpents are restricted to creeping, and for this purpose, according to the observations of BANKS and HOME, they avail themselves of their numerous ribs, the extremities of which they alternately fix on the ground and slide forwards, just as caterpillars and myriapods deal with their feet. *Philos. Transact.* for 1812, p. 163 sqq.

Most serpents keep by preference in moist places, and within the tropics shew themselves chiefly in the rainy season. In this order very large animals are met with, which attain a length of 20 or 30 feet[1], and on the other hand species also which are scarcely a span long.

Compare on this order PATRICK RUSSELL, *An account of Indian Serpents, collected on the coast of Coromandel*, London, 1796, fol. *Continuation*, London, 1801; F. BOIE *Bemerkungen über* MERREM'S *Versuch eines Systems der Amphibien. Erste Lieferung; Ophidier* in OKEN'S *Isis* 1827, s. 508—566; H. SCHLEGEL *Essai sur la Physionomie des Serpens*, La Haye, 1837, 8vo, *et Atlas contenant 21 planches et 3 cartes*. SCHLEGEL'S work has been translated (abridged) into English, see p. 234. Here may be added, on the habits of the serpents of Germany, the prolix work of H. O. LENZ *Schlangenkunde*. Mit Abb. Gotha, 1832, 8vo, containing many of his own observations. The most recent arrangement of DUMÉRIL and BIBRON (*Erpétologie*, Tom. VI. VII.) founded on the disposition of the teeth, is given in a succinct revision by the former in the XXIII. Vol. of the *Mém. de l'Acad. des Sciences*, 1853. It need scarcely to be mentioned that exclusive attention to this point has occasioned artificial genera and arbitrary separations or combinations.

TRIBE I. *Serpentes.*

Tongue bifid, exsertile. Lower jaw divided in the middle.

A. *Eurystomi.*

Palate-bones mobile, armed with sharp, recurved teeth. Quadrate bone mobile, suspended to the mastoïd bone, itself mobile,

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[1] ADANSON speaks of serpents 40 or 50 feet long, which however were not seen by himself. *Hist. nat. du Sénégal*, p. 150.

in most. The two branches of lower jaw conjoined by a cartilaginous elastic ligament. Mental furrow.

The serpents with a large mouth capable of great expansion on deglutition, form the largest part of their order, and exhibit to us the proper *typus* of it. Along the under jaw on each side lie a row of scutes (*Scuta marginalia labii inferioris*), between which two pairs of mental scutes (*Scuta mentalia*) are situated, and again in front of these two small scutes, behind the unpaired scute at the point of the lower jaw (*Scutum labiale medium*). Between these mental scutes there runs in the middle a longitudinal furrow.

The upper jaw is formed by two upper jaw-bones and a single intermaxillary bone. The upper jaw-bones are longer in the innocuous serpents, and armed with a row of teeth, continued throughout. In the poisonous serpents, on the contrary, the upper jaw-bones are short, and the outer pterygoïd bone (*Os pterygoïdeum externum*) to which they are fastened, is transformed into a much elongated style.

† *Venomous serpents.* (*Solenoglyphes*, previously *Thanatophides*, DUM. and BIBR.)

The venomous serpents, amongst which are some whose bite has for men speedy death as a consequence, have brought an evil name upon the whole order. They are, however, far less numerous than the innocuous species. Even in Brasil, for instance, according to the Prince of NEUWIED, the innocuous species are to the venomous as 38 : 5. This is the place to say something on the poison-glands and poison-teeth of serpents.

In most poisonous serpents each superior maxillary bone has only a single tooth projecting from the gum, and, to succeed to which, two or three others behind and above it lie upon the palate with their point turned backwards. Through these teeth there runs a canal which opens close to the point on the convex anterior surface with a fine fissure. In some poisonous snakes the upper maxillary bone has some smaller teeth in addition, which are not perforated, and succeed further back to the poison-tooth. Finally, there are (as was first observed by Professor REINWARDT and confirmed by the investigations of BOIE, and especially of SCHLEGEL, by whom this peculiarity was published,) some serpents which have a tooth behind a row of imperforate teeth which is a little longer

than the rest, and is not perforated but grooved[1]. In these last the excretory duct of a gland is received in the groove, the gland agreeing in texture with the superior maxillary salivary gland or seeming merely to be a lobe of it, whence it has been supposed that these serpents do not belong to the venomous division.

The large perforated tooth, placed on each side of the mid-plane at the fore part of the mouth, is the means by which the venomous serpents inflict wounds and shed the poison into them. The poison is secreted by a gland of an elongate form which is situated behind and under the eye upon the upper jaw, and is compressed by the temporal muscle. It consists of blind tubes, which in some are undivided, in others ramified and disposed in flat lobes or plates that are separated from each other by partitions of the membrane that surrounds the gland[2]. The long excretory duct of this gland runs forward and ends in a membranous sheath which surrounds the base of the poison-gland; here the poison is received in an aperture situated in front of the base of the tooth. Besides this gland there are still others in the head of serpents, viz. along the edge of the upper and lower jaw, under the tongue, and lastly a lachrymal gland behind the eye; these glands are common to the venomous and innocuous serpents, yet all of them are not always equally present. The poison-gland, on the contrary, is peculiar to the venomous serpents, and in these the other glands of the head, especially those along the margin of the jaws, are generally less developed[3].

As to the poison itself, it is an unctuous gelatinous fluid, without taste, and drying in the air into little plates or scales; it long retains its injurious power, is soluble in water, insoluble in spirit of wine and volatile oils, and is generally stated to be neither of an alkaline nor an acid nature[4]. CANTOR, however, has found that the poison

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[1] H. SCHLEGEL, *Onderzoeking van de speekselklieren der slangen met gegroefde tanden, in vergelijking met die der niet giftige en giftige*, in the *Bijdragen tot de natuurk. Wetenschappen*, II. 1827, bl. 536—551, and in the *Nov. Act. Acad. Cæs. Leop.* Tom. XIV. DUVERNOY afterwards treated this subject more at large, *Annales des Sc. nat.* Tom. XXVI. Paris, 1832, pp. 113—160, Pl. 5—10, and again in a Supplement, *ibid.* Tom. XXX. pp. 6—32.

[2] See J. MUELLER, *De glandularum secernentium structura penitiori*, pp. 55—57. Pl. VI. fig. 1—3.

[3] Compare on these different glands, besides DUVERNOY loc. cit., also MECKEL in his *Archiv f. Anat. u. Physiol.* 1826, s. 1—13, Tab. I. figs. 1—10.

[4] See the celebrated work of F. FONTANA, *Traité sur le venin de la vipère*, &c. Florence, 1781, II. Tom. 4to.

of *Dendroaspis* (*Hamadryas*) and of some other Indian snakes reddens litmus paper slightly[1]. The same fact is noticed by HARLAN with regard to *Crotalus*[2]. In common with other animal poisons and contagious matters a very small quantity is sufficient to produce the effect. The poison of serpents is innocuous, if introduced into the digestive passages by swallowing, but shews its natural action when, by a wound or by being introduced into a vein, it enters the current of the blood. The bite of all venomous serpents is not equally dangerous to man; of some the effect is extraordinarily rapid; death mostly occurs after violent spasms and other nervous symptoms, and the body quickly becomes decomposed.

Family V. *Viperina.* Upper jaw with a single large perforate tooth on each side. Head cordate or trigonal, broader than trunk.

Crotalus L. Pit between the nostrils and eyes on each side. Trunk and tail scaly above, scutate below, with all or most of the subcaudal scutes simple (unpaired). Rattle composed of horny rings, different in number, at the end of tail.

Rattlesnake, Klapperschlange, Serpent à sonnettes, &c. The rattle consists of horny pieces varying in number with the age of the individual. The last (3—8) vertebræ of the animal coalesce to form a terminal bone of a compressed conical form. This is covered by muscle and skin. The skin is here thick and spongy, and has the general conical form of the bone below it, but has also two deep annular grooves which divide it into three transverse swellings, decreasing in size from before backward. This skin secretes the pieces of the rattle in succession. In adult animals the rattle may consist of 20—30 hollow horny joints. The joints decrease in size from the base to the extremity of the rattle, each joint the farthest successively from the end having been secreted at a period when the secreting surface was larger. The pieces hang loosely but securely together, the basal ring of one joint grasping the projecting second ring of the preceding joint, and this again inclosing the third ring of the joint next but one preceding. Since the second rounded annular portion of each joint is thus securely grasped by the first rounded annular portion of the piece behind it, and the third by the second, and yet all of them so loosely as to leave room for motion, it has been supposed that when the uppermost piece has been completed and a new piece above this is about to be formed, the skin which is to secrete it is so modified that its first swelling which secreted the first projection of the former piece assumes that shape and size which

[1] CANTOR, *Proceedings of Zool. Society,* 1838, p. 75.

[2] HARLAN, *Medical and Physical Researches,* p. 501, quoted by CANTOR.

are accommodated to the shape and size of the second projection of the new piece, whilst the second swelling which secreted the second projection of the piece takes the dimensions suited to the third projection of the future new piece. It is further supposed that these two swellings are caused to move from before backward by the development of a new swelling of the skin suited to the dimensions of the first projection of the new piece which is to be secreted by it. It will be understood that all that is visible of the rattle externally is the surface of the basal projections or rings of each succeeding joint. The first joint alone has vital connexion with the skin of the animal; it is caused to vibrate by the muscles of the skin, and its vibration communicates a quivering motion, accompanied by sound, to the dry horny pieces behind it. See J. CZERMACK *Uber den schallerzeugenden Apparat von Crotalus. Zeitschr. f. wissensch. Zool.* VIII. 1856, pp. 294—301. Taf. XII.

The species of this genus are all found in America. They are highly venomous, but dull. The species from South America (from Surinam, Brasil) has not only the part of the head in front of the eyes covered with scutes, but also four small scutes above the eyes. This appears to be the species which may be regarded as *Crotalus Durissus* L. On the back are seen rhomboidal spots lighter in the middle. VOSMAER *Beschrijv. van eene Surinaamsche ratelslang*, 1768, 4to; MAXIM. *Abb. zur Naturgesch. Brasil.* Lief. XI.; CUV. *R. Ani., éd. ill., Rept.* Pl. 32. A large species from North America has scales between the eyes and brown transverse bands, *Crotalus horridus* L., GUÉRIN *Iconogr., Rept.* Pl. 23, fig. 2, *Crotalus durissus* HOLBR., *N. American Herpetology*, II. Pl. 17. DAUDIN, SCHLEGEL, and DUMERIL make an opposite use of these Linnean names.—A smaller species from North America, *Crotalus miliarius* L., has a more oval head covered with scutes (one *scutum vertebrale* and two *scuta occipitalia*). HOLBR. l. l. Vol. II. Pl. 15.

Trigonocephalus OPPEL, *Cophias* MERREM. Tail round, with apex simple, conical; several subcaudal scutes in pairs, with unpaired interposed. Remaining characters those of the preceding genus.

a) *With head scaly.*

Cophias BOIE. (*Lachesis* DAUD., *Craspedocephalus* KUHL, *Bothrops* WAGLER, &c.)

Sp. *Trigonocephalus crotalinus* nob., *Crotalus mutus* L., SCHLEG., *Lachesis rhombeata* MAXIM. *Abb. z. Naturg. Bras.* Lief. V. *Surukuku* (*Curucucu* MARCGR.); the tail has at the base first two or three undivided scutes; to these succeed the paired scutes; the extremity of the tail both above and below is covered with scales, and terminates in a horny point. This serpent is found in Guiana and Brasil, and is very dangerous; it attains a length of 10′.

Trigonocephalus atrox SCHLEG., *Coluber atrox* L., *Mus. Ad. Frid.* Tab. 22, fig. 21; Brasil, Surinam;—*Trigonocephalus viridis* CUV., *Bothrophis*

viridis FITZ., *Trimeresurus viridis* LACEP., *Ann. du Mus.* IV. Pl. 56, fig. 2, *Bodrwopam* RUSSELL, *Ind. Serp.* Pl. 9; East Indies, Sunda-islands, New Holland, &c.

b) *With head scutate.*

Trigonocephalus BOIE (*Tisiphone* FITZ., *Trigonocephalus* FITZ., and *Cenchris* DAUD., FITZ.)

Sp. *Trigonocephalus Cenchris* SCHL., *Cenchris mokeson* DAUD., *Rept.* V. Pl. 60, fig. 25, Pl. 70, figs. 3, 4, *Trigon. contortrix* HOLBROOK l. l. Vol. II. Pl. 14, in North America[1]; *Trigonocephalus rhodostoma* REINW., *Leiolepis rhodostoma* DUM., SCHLEGEL *Abbild.* Pl. 19, 49, Java. KUHL saw two workmen in Buitensorg die in a few minutes after having been bitten by this serpent.

Vipera DAUD., SCHLEG. Pit between nostrils and eyes none.

Note.—All the species hitherto known are from the eastern hemisphere.

Vipera DAUD. Subcaudal scutes paired.

a) *With head covered above with scales or graniform scutes. Echidna* MERR. (*Vipera* LAURENTI.)

Sp. *Vipera Cerastes, Coluber Cerastes* L., LACEP. *Quadr. ovip. et Serp.* II. Pl. 1, fig. 2, DAUD. *Rept.* VI. Pl. 74. fig. 2, BRUCE *Travels to discover the source of the Nile,* Edinb. 1790, V. Pl. opposite p. 199, *Dict. univ. d'Hist. nat., Rept.* Pl. 13, fig. 2; lancet-shaped, strongly keeled scales, light grey-yellow colour; two little horns above the eyes, variable in their development and sometimes entirely absent; this serpent, which occurs in Egypt, was known to the ancients, who make mention of it in different places. MERREM confounds with it a species from South-Africa, which has some erect scales above the eyes, but is coloured quite differently, *Vipera cornuta* DAUD., *Vipera lophophrys* CUV.;—*Vipera ammodytes* DAUD., *Coluber ammodytes* L., *Amœnit. Acad.* I. p. 506, Tab. 17, fig. 2, DAUD. *Rept.* VI. Pl. 74, fig. 1, STURM *Fauna, Amphib.* Heft 2; at the point of the head a conical, erect and scaly tubercle; this species occurs in the south and especially the south-east of Europe.—*Vipera aspis* SCHL. *Coluber Aspis* L., *Vipera berus* CUV., GUÉRIN *Iconogr., Rept.* Pl. 23, fig. 1; France, Italy, &c. To this species the observations and experiments of CHARAS refer, *Nouvelles Experiences sur la Vipère.* Paris, 1669, 8vo.

b) *With head covered above with small scutes. Pelias* MERR. (*Coluber* LAUR.)

Sp. *Vipera berus* DAUD., *Coluber Berus* L. (and *Chersea* L.), *Vipera chersea* CUV., LAURENTI *Synops. Rept.* Tab. II. fig. 1, *Coluber chersea* STURM,

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[1] *Toxicophis leucostoma* TROOST, described in *Ann. of the Lyceum of Nat. Hist. of New York,* III. 1825, p. 174, known to me only from an extract in OKEN'S *Isis* 1844. S. 113, 114; is referred by DUMÉRIL to *Trigonocephalus piscivorus.*

Faun., Amphib. Heft 3, BELL *Brit. Rept.* p. 61, CUV. *R. Ani., éd. ill., Rept.* Pl. 31, fig. 2, VAN LIER *Verhandel: over de slangen en adders van het landschap Drenthe,* Amsterdam, 1781, 4to, Pl. II. bl. 84 and foll.; *adder, viper, Vipère commune, Natter* &c. In many countries of Europe, in Sweden, Russia, Germany, England, north of France, Lombardy, &c. The number of unpaired abdominal scutes is about 140, and of the caudal scutes there are 40—43 pairs. The bite of this species is but seldom fatal to man, and VAN LIER states that, after all his inquiries, he has not been able to find a single example in the district Drenthe of death having followed the bite of a viper. BELL gives the same as the result of his investigations in England; the viper of the south of Europe, recorded above, *Vipera aspis,* appears to be more dangerous. *Vipera prester, Coluber prester* L. is generally considered to be a variety of *Vipera berus;* it is quite black; it is the *Coluber Vipera anglorum* LAURENTI l. l. Tab. IV. fig. 1; STEENSTRUP regards it as a distinct species; KRŒYER'S *Tidskrift,* II. 1839, pp. 544, 545.

Echis MERR., DUM. and BIBR., *Scytale* DAUD. Subcaudal scutes unpaired. Head scaly.

Sp. *Vipera echis* SCHLEG., *Scytale bizonatus* DAUD., *Echis carinata* MERR. (*Vipera pyramidum, Descr. de l'Egypte*), *Echis pavo* REUSS, DAUD. *Rept.* V. Pl. 70, fig. 1, copied from RUSSELL;—*Echis frenata* DUM. and BIBR., *Echis arenicola* and *Echis varia* REUSS, *Mus. Senkenb.* I. Tab. VII. fig. 2; species from North Africa and the continent of the East Indies.

Acanthophis DAUD., WAGL., *Ophryas* MERR. Tail with several unpaired scutes below, towards the extremity covered with scales, with apex aculeate. Head scutate; superciliary scute erect, prominent.

Sp. *Vipera palpebrosa* nob., *Acanthophis cerastinus* DAUD., DUM. and BIBR., *Ophryas Acanthophis* MERR., MERREM *Beiträge,* II. Tab. 3, GUÉRIN *Iconogr., Rept.* Pl. 24, fig. 2; in New Holland.

Family VI. *Elapina.* Upper jaw with a large grooved tooth and some other smaller and solid placed behind it. Head scutate, differing in breadth from the trunk slightly or not at all. Tail round, short, often conical or fusiform.

Sepedon Merrem (Species of *Naja* BOIE, SCHLEG.). Teeth in upper jaw none except the poison-tooth. Head short, conical. Loral scute none[1]. Scales carinate. Tail below covered with paired scutes.

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[1] For the explanation of the terminology of the scutes of the head employed by MERREM, and of which we here and elsewhere make use, see Pl. XX. figs. 5, 6, 7, of this volume.

Sp. *Sepedon hæmachates* MERR., FITZ., DUM. and BIBR., SEBA *Thesaur.* II. Tab. 58, figs. 1—3, LAC. *Quadrup. ovip. et Serp.* II. Pl. 3, fig. 2; habitat Cape of Good Hope.

Naja LAUR. Head flat above, with eyes lateral. Posterior ocular scutes three. Frenal scutes none. Anterior part of trunk behind the head expansible into an oval depressed disc. Scales smooth. Subcaudal scutes paired.

All the species of this genus are from the eastern hemisphere. They have, without exception, smooth scales, which are very large and lancet-shaped. That this genus belongs to the present division was, as I suppose, first shewn by SCHLEGEL; I find, besides the poison-tooth, only a single small tooth in the cranium examined by me, at some distance from it at the posterior extremity of the short upper jaw-bone. The anterior ribs (about 20 pairs) lie flat, *i.e.* they do not bend downwards, and increase in length to the tenth or eleventh pair, after which they become gradually shorter. When these ribs are drawn forwards an oval expansion is caused, surpassing the head in breadth, which characterises most of the species of this genus, but not all in an equal degree[1]. The name of *spectacle-snake, serpent à lunettes,* is borrowed from two eye-like spots on the disciform expansion of the back, which are connected by a black streak curved forwards, a mark, however, which occurs only in one species. This is *Naja tripudians* MERR., *Coluber Naja* L., *Aspis Naja* WAGL., LINN. *Mus. Adolph. Frid.* Tab. 21, fig. 1, SEBA *Thes.* II. Tab. 90, fig. 2, (and less good in different figures of that great work), CUV. *R. Ani., éd. ill., Rept.* Pl. 34; in Bengal.—*Naja haje* MERR., *Coluber Haje* L., *Uræus Haje* WAGL.; in Egypt; brownish, head of a lighter colour with a dark ring round the eye, which at the margin of the upper jaw terminates in a small spot. On this species the so-called *serpent-charmers* in Egypt, as on the preceding in India, exercise their art. The *Koperkapel* (*Cabra di Capello*) of the Dutch Colonists is a variety of the same species.

Causus WAGL., DUM. and BIBR. (Species of *Naja* BOIE, SCHLEG.) Teeth in upper jaw besides the poison-tooth none. Frenal scute small. Dorsal scales subcarinate. Remaining characters almost those of the preceding genus.

Sp. *Causus rhombeatus* WAGL.; *Vipera V nigrum* CUV., *Sepedon rhombeatus* LICHTENST., SCHLEGEL *Phys. d. Serp.* Pl. 17, figs. 12, 13 (head); coast of Guinea, Cape of Good Hope.

Dendroaspis FITZ. (*Trimeresurus* DUM., BIBR., add *Alecto* eorumd.) Some small solid teeth in upper jaw behind the poison-tooth. Posterior ocular scutes two or three; frenal scute none.

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[1] Compare HOME *Philos. Transact.* for 1804, pp. 346 and foll.

Scales smooth. Tail below covered with undivided scutes, or partly with paired, partly with undivided scutes.

Sp. *Dendroaspis ophiophagus, Hamadryas ophiophagus* CANTOR, *Proceedings of Zool. Soc.* 1838, p. 73, *Naja Bungarus* (and *Naja Elaps* according to DUMER.) SCHLEG. *Verh. over de natuurk. Gesch. der nederl. overzeesche bezittingen, Rept.* Pl. 10; Java, Sumatra;—*Dendroaspis porphyriaca, Naja porphyrica* SCHL., *Phys. d. Serp.* Pl. 17, fig. 9, (head), *Acanthophis tortor* LESS., GUÉRIN *Iconogr., Rept.* Pl. 24, fig. 1; New South Wales.

Dendroechis FISCH., *Dendroaspis* SCHLEG. (not FITZ.) Head flat above, scutate, elongate. Some small solid teeth in upper jaw behind the poison-tooth. Posterior ocular scutella four. Frenal scute none; with frontal scutes at the sides of the head behind the nasal scute produced on each side to the marginal scutes of upper lip. Scales large, smooth, thin, in the middle of back larger. Scales at the sides of abdominal scutes smaller, lanceolate, imbricate, with apex acuminate, horny.

Sp. *Dendroechis Jamesonii, Elaps Jamesonii* TRAILL, *Dinophis Hammondii* HALLOWELL, *Journal of Acad. of nat. Sc. Philad.* Sec. Series, II. 1854, Pl. 29, T. G. FISCHER *Abhandl. der naturhist. Vereins zu Hamburg.* III. 1856, Tab. 1; from the west coast of Africa. This snake grows to a length of 5 or 6 feet, and has a slender elongated form; lives on trees, and represents *Dendroaspis* in the Naja-tribe. Dr SCHLEGEL has given a short notice of this species in *Verslag der werkzaamheden van het Zoologisch Genootschap te Amsterdam.* March, 1848.

Elaps SCHN., MERR. (excl. some species). Head small, flat above, scutate. Eyes small. Gape of mouth narrow; upper jaw gibbous, obtuse, protracted beyond lower. Body slender, round. Subcaudal scutes paired.

Sp. *Elaps lemniscatus* MERR., *Coluber lemniscatus* L., *Mus. Ad. Frider.* Tab. XIV. fig. 1, SEBA *Thesaur.* II. Tab. 76, fig. 3, (and other places), Surinam;—*Elaps corallinus* MERR., CUV. *R. Ani., éd. ill., Rept.* Pl. 35. fig. 1, MAXIM. *Abb. z. Naturg. von Bras.*, Lief. VI. Brasil. Species are also found in the East Indies, Africa and New Holland. They are mostly black snakes, ringed with white and red. See also SCHLEGEL *Abb. neuer Amphib.* Taf. 46, 47. A South-African species is *Elaps Hygeæ* MERR., *Coluber lacteus* L. *Mus. Ad. Frid.* Tab. 13, fig. 1, MERREM *Beiträge*, I. Tab. VI. Another South-African species was placed by SCHLEGEL in the genus *Naja, Elaps lubricus* MERREM, *Beitr.* I. Pl. 2. This species is the type of the subgenus *Aspidelaps* FITZ.

In these species and many others, according to DUMÉRIL and BIBRON, there are no teeth in the superior maxillary bones except the grooved poison-fangs. There are other species with several small solid teeth following the fangs; DUMÉRIL and BIBRON have founded on these a separate

genus *Pseudelaps* (*Aspidomorphus* FITZING.). Here also several small snakes of Australia seem to find their place. They shew some resemblance to *Calamaria*, in which genus SCHLEGEL placed the only one known to him (*Calamaria diadema*). With DUMÉRIL and BIBRON these species form the genus *Furina*.

Bungarus DAUD., MERR., DUM. and BIBR., *Aspidoclonion* WAGL. Head scutate above, obtuse. Several small teeth behind the poison-fang in upper jaw. Subcaudal scutes all unpaired. Larger hexagonal scales, in a single row in keel of back.

Sp. *Bungarus candidus mihi*, *Bungarus semifasciatus* KUHL, SCHLEG., *Coluber candidus* L., *Mus. Ad. Frid.* Tab. VII. fig. 1, *Bungarus cæruleus* DAUD., DUM., BIBR., RUSSELL *Serp.* I. fig. 1; according to DUMÉRIL and BIBRON a distinct species;—*Bungarus annularis* DAUD., RUSSELL, Pl. III., DAUD. *Rept.* V. Pl. 65; compare also SCHLEGEL, *Abbild.*, Tab. 18; both from the continent and the large islands of the East Indies.

Note.—Here would seem to belong *Megærophis*, a genus indicated by GRAY, *Annals of Nat. Hist.* Second Series, IV. 1849, p. 247.

Family VII. *Hydrophes.* Head scutate, small. Several small slender teeth in upper jaw behind the poison-fang. Body round, elongate, slender anteriorly, gradually becoming thicker and terminating in tail, compressed, broad, two-edged. Scales hexagonal, often scarcely imbricate, covering body as though with a net.

Water-snakes. Some species occur occasionally at the mouth of rivers, others live in the open sea, where they are often met with far from all land; they swim together in large troops, and are very venomous. ÆLIANUS has very distinctly indicated these serpents as inhabitants of the Indian sea, with a flat tail, and many teeth in their mouth. *De Natura Animal.*, Lib. XVI. c. 8.

Compare CANTOR *Observations upon pelagic Serpents*, *Trans. of Zool. Soc.* II. 1839, pp. 303—313, Pl. 56, and T. G. FISHER *Die Familie der See-schlangen systematisch beschrieben. Abhandl. herausgegeb. von dem naturhist. Verein in Hamburg*, III. 1856, pp. 1—78, Tab. I—III.

Platurus LATR., DAUD., FITZ. (and *Aipysurus* LAC., DUM., BIBR). Abdomen scutate; subcaudal scutes in a double row. Scales smooth.

Sp. *Platurus colubrinus* nob., *Platurus fasciatus* LATR., *Coluber laticaudatus* L., *Mus. Ad. Frid.* Tab. XVI, fig. 1, CUV. *R. Ani.*, *éd. ill.*, *Rept.* Pl. 36; in the Indian Ocean.—*Aipysurus lævis* LAC., *Thalassophis anguillæformis* SCHMIDT, *Ann. du Mus.* IV. Pl. 56, fig. 8, (a distinct species).

Hydrophis DAUD., *Enhydris* MERR. Scales carinate with a tubercle in the middle, hexagonal. In the keel of abdomen a row of larger scales biturberculate, sometimes irregular and divided throughout.

Sp. *Hydrophis doliatus, Disteira doliata* LAC. *Ann. du Mus.* IV. Pl. 57, fig. 2; —*Hydrophis gracilis* SCHL., *Hydrophis fasciatus* GUÉRIN, *Iconogr., Rept.* Pl. 25, fig. 1, RUSSELL *Serp.* I. Pl. 44, CANTOR l. l. Pl. 56.—*Hydrophis striatus* SCHLEG. *Faun. Japon., Serp.* Pl. 7, &c.[1]

Acalyptus DUM. BIBR. Head scaly posteriorly, with occipital scute none. Scales imbricate.

Sp. *Acalyptus superciliosus* DUM., BIBR.; from PÉRON's *Voyage*, considered by SCHLEGEL as a variety of *Hydrophis palamidoides*.

Pelamys DAUD. Abdomen and tail covered below with small hexagonal scales, tuberculate in the middle. Abdomen compressed below, with acute margin between two rows of scales.

Sp. *Pelamys bicolor* DAUD., *Hydrophis Pelamis* SCHLEG., RUSSELL *Serp.* I. Pl. 41, VOSMAER *Beschrijving van de bruinrug-platstaart-slang*, 1774, CUV. *R. Ani., éd. ill., Rept.* Pl. 36 bis, fig. 1; in the Indian Sea and South Pacific; the most common species of this family.

†† *Innocuous serpents.*

A. *With last tooth of upper jaw larger than the rest, sulcated.*

Family VIII. *Asineophes* s. *Glyphodontes* (*Opisthoglyptes* DUM. and BIBR.) Head scutate. Subcaudal scutes almost always in pairs.

Dipsas LAUR. Head flat above, broader than trunk, triangular, obtuse anteriorly. Eyes large. Body compressed. Tail acuminate, long. Mostly a row of larger hexangular scales in the keel of back.

Sub-genera: *Telescopus* WAGL., DUM., BIBR., *Rhinobothryum* WAGL., DUM., BIBR., *Himantodes* DUM., BIBR., *Triglyphodon* DUM., BIBR. (*Cephalophis* FITZ.), *Anholodon* DUM., BIBR., *Heterurus* DUM., BIBR.

Sp. *Dipsas Nattereri* SCHLEG., (*Dryophylax*), *Coluber Nattereri* MIKAN., MAX. *Pr. v.* WIED, *Abb., Liefer.* XIV.;—*Dipsas Cynodon* CUV., *Opetiodon Cyno-*

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[1] *Hydrophis palamidoides* SCHLEG. belongs to this genus, and not to *Pelamys*. Here also is to be placed *Hydrophis schizopholis* SCHMIDT; *Abhand. herausgegeben von dem naturwissensch. Verein in Hamburg*, I. 1846, Taf. XV. (afterwards raised into a new genus by FISCHER l. l. p. 37, under the name of *Astrotia*).

don DUM., BIBR., GUÉRIN *Iconogr., Rept.* Pl. 21, fig. 2; this species from the Sunda Islands attains a considerable size (7′ or 8′); there is an oblique black stripe behind the eye.

Dryophis DALMAN, BOIE, *Dryinus* MERR. Head narrowed, triangular, elongate, excavated at the sides in front of eyes, flat above. Upper jaw protracted beyond lower. Scales narrow, lanceolate. Body slender; tail often longer than half the trunk, thin, acuminate.

a) *With scales carinate. Dryophis* WAGL. (*Xiphorhynchus* WAGL., DUM., BIBR.)

Sp. *Dryophis fulgidus* WAGL., *Coluber mycterizans* L. (in part), *Dryophis Catesbyi* SCHLEG. *Abb.* Tab. 36; in the southern part of North America and in Surinam;—*Dryophis Langaha* SCHLEG. (*Xiphorhina* FITZ.), *Langaha madagascariensis*, BRUG. *Journal de Physique*, 1781, *Février*, LACEP. *Quadrup. ov. et Serp.* II. Pl. 22, fig. 1, SCHLEG. *Abb.* Tab. 7, figs. 7—11; Madagascar; this species is grey-brown, and has at the head forwards a long, pointed and scaly appendage.

b) *With scales smooth. Tragops* WAGL., DUM., BIBR. (and *Dryinus* DUM., BIBR., *Oxybelis* WAGL., DUM., BIBR.)

Sp. *Dryophis nasutus* BOIE, LACEP. II. Pl. 4, fig. 2, RUSSELL *Serp.* I. Pl. 12, GUÉRIN *Iconogr., Rept.* Pl. 22, fig. 2; found on the continent of India, as also in the Indian Archipelago; this species is bright green, with a yellow stripe on each side along the belly. The pupil is a transverse fissure, as in *Dryophis prasinus* REINW., SCHLEG. *Abb.* Tab. VIII. figs. 1—6, a very common species in the same countries. All these snakes live on trees.

Psammophis BOIE, FITZ. Head narrow, towards the apex rotundato-acuminate. Anterior lower teeth longer. Eyes large, covered by the exsert margin of superciliary scute; pupil round. Body elongate, with scales lanceolate or elongato-hexangular, mostly smooth. Tail longer than half the trunk, covered below with scutes in pairs.

a) *With middle teeth in upper jaw longer.*

Sp. *Psammophis sibilans* nob., *Coluber sibilans* L., *Coluber moniliger* LACEP. *Quadr. ovip. et Serp.* II. Pl. 12, fig. 1; in almost the whole of Africa, in Egypt, on the coast of Guinea, and even as far as the Cape of Good Hope, from whence it was described and figured by MERREM, *Beitr.* I. Taf. 3, under the name of *Coluber crucifer;* DUMÉRIL and BIBRON, however, believe this to be a distinct species.

b) *With teeth in upper jaw equal, except the last, which is grooved.* (*Cœlopeltis* WAGL., DUM. and BIBR.)

Sp. *Psammophis lacertinus* SCHLEG., *Cœlopeltis lacertina* WAGL., *Rhabdodon fuscus* F. L. FLEISCHMANN, *Dalmatiæ nova serpentium genera.* Erlangæ, 1831, 4to, Tab. II.; this snake is found in the south of Europe and the North of Africa; the scales are grooved in the middle; this species attains a length of more than 4'.

Bucephalus SMITH, DUM., BIBR.

Sp. *Bucephalus typus* SMITH, *Dendrophis colubrina* SCHLEG., *Dispholidus Lalandii* DUVERNOY, CUV. *R. Ani., éd. ill., Rept.* Pl. 29; Cape of Good Hope, *Boomslang* of the Dutch Colonists.

Note.—Here also is the place for some new genera of DUM., BIBR. *Hemiodontus, Chorisodon,* and *Tomodon.*

Tarbophis FLEISCHMANN, DUMÉR., *Ailurophis* FITZ., BONAP. Head small, distinct from trunk. Frenal scute produced to eye. Eyes moderate, with pupil vertical, narrow. Anterior lower teeth longer. Tail short, covered below with scutes in pairs.

Sp. *Tarbophis fallax* FLEISCHM., *Dipsas fallax* SCHLEG., *Ailurophis vivax* FITZ., FLEISCHMANN l. l. Tab. I. BONAP. *Faun. Ital. Amfibi.*, Tab. 68; in the south-eastern part of Europe; it attains a length of about 2'.

Lycognathus DUM., BIBR.

Sp. *Lycognathus scolopax* DUM. and BIBR., *Lycodon audax* BOIE, SCHL., *Sibophis audax* FITZ., *Coluber audax* DAUD. *Rept.* VI. Pl. 19, South America.

Homalopsis KUHL, FITZ. Head elliptic, depressed anteriorly, with small scutes; sometimes scales in place of occipital scutes. Eyes small, superior. Nostrils horizontal, small, situated towards the apex of snout. Trunk cylindrical, thick, covered below with short scutes. Tail thin, much shorter than trunk.

Sp. *Homalopsis buccatus* KUHL, *Coluber buccatus* L., SEBA *Thesaur.* II. Tab. 12, fig. 1, Tab. 21, fig. 3, LINN. *Mus. Ad. Frid.* Tab. 19, fig. 3, MERR. *Beijtr.* II. Tab. 10, Java;—*Homalopsis Schneideri* SCHLEG., *Coluber Schneiderianus* DAUD., *Cerberus Russellii* CUV., *Cerberus boæformis* DUM., BIBR., SEBA *Thesaur.* II. Tab. 15, fig. 3; East Indies, New Guinea. These serpents reside in lakes and rivers; they live mostly on fish.

Note.—Here belong the sub-genera: *Hypsirhina* WAGL., (*Homalopsis Aër* SCHL.), *Eurostus* DUM., BIBR., *Trigonurus* DUM., BIBR., *Campylodon* DUM., BIBR., *Cerberus* CUV.

Herpeton LAC., *Rhinopirus* MERR. Two scaly appendages in front of nostrils. Abdominal scutes minute, bicarinate. Tail scaly below.

Sp. *Homalopsis herpeton* SCHLEG., *Herpeton tentaculatum* LAC. *Ann. du Mus.* II. Pl. 50, GUÉRIN *Iconogr., Rept.* Pl. 20. fig. 3, SCHLEGEL *Abb.* Tab. 16.

Erythrolamprus F. BOIE, WAGL. (Species of *Coronella* SCHL.) Head narrow, not distinct from trunk, with snout obtuse, short. Eyes moderate, with anterior ocular scute single, posterior ocular scutes two. Teeth small, numerous, equal, except the posterior upper tooth. Scales smooth. Tail short, acuminate at the extremity.

Sp. *Erythrolamprus agilis* WAGL., *Coluber agilis* (and *Coluber Æsculapii*) L., *Mus. Ad. Frid.* Pl. II. fig. 2, Pl. 21, fig. 2, SEBA *Thes.* II. Tab. 18, fig. 4, MERREM *Beytr.* I. Tab. V. Surinam.—*Erythrolamprus venustissimus* WAGL., *Coluber venustissimus* MAXIM. *Pr. v.* WIED, Lief. I. Tab. VI. and Lief. VII. Tab. 2, var.; Brasil. Bright coloured snakes, with white, black and red rings, marked almost like the *Elaps corallinus* (see above, p. 264), which lives in the same countries, with which it may be easily confounded on superficial examination, but may at once be distinguished by the much larger eyes.

Note.—To this division also are to be referred *Elapomorphus* WIEG., DUM., BIBR., *Homalocranion* and *Stenorhina* DUM., BIBR. —*Scytale* BOIE, DUM., BIBR.; and some other genera of those authors comprehend species with nearly equal teeth, and are placed by SCHLEGEL chiefly in his comprehensive genus *Lycodon* (DUM. and BIBR. VII. 2, p. 988—1046). It requires further investigation to determine whether *Scytale coronata* MERR., MAXIM. *Prinz zu* WIED, *Abb.* Lief. VII. (with undivided subcaudal plates) be really distinct from *Coluber Clelia* DAUD., which is placed in a distinct genus, *Deiropeda* FITZINGER, *Brachyruton* DUM., BIBR., although SCHLEGEL considers both as varieties of the same species.

B. Without any sulcated tooth (*Stereodontes* s. *Aglyphodontes* DUM., BIBR.)

Family IX. *Colubrina.* Spurs (rudiments of posterior extremities) none. Head scutate. Tail covered below with paired scutes.

LINNÆUS united all the serpents that have divided scutes, as they are called, on the under surface of the tail, or better two rows of scutes, in a single genus which he named *Coluber.* After the poisonous serpents (*Vipera, Naja, Elaps,* &c.) and those which have a grooved posterior tooth in the upper jaw have been separated from them, there still remain very many species which

CUVIER left together in a single large genus, *Coluber*. The Pythons, large serpents from the Eastern Hemisphere, which correspond to the Boas, it was thought right, notwithstanding the divided caudal scutes, to place in the neighbourhood of these last. LINNÆUS was acquainted with only one species of the former, which he had seen in the cabinet of DE GEER, (*Coluber molurus*[1]). In this way a large genus or natural family remained, in which modern writers, especially BOIE[2], and afterwards WAGLER, FITZINGER, DUMÉRIL and BIBRON, adopted many more genera, which they distinguished by the form of the head, by the size of the teeth, &c. We shall not record all these genera, but only those which appear to be most natural, and are distinguished in some other respects, as by their peculiar interest or the number of their species.

Xenodon BOIE, FITZ. (add. *Liophis* WAGL.). Head flat, broad. Gape of mouth ample; upper jaw with apex rounded, obtuse, emarginate, mostly longer than lower. Last tooth or two last of upper jaws longer than the rest, compressed, ensiform. Eyes moderate. Trunk thick, round, or with back carinate and abdomen compressed. Scales smooth.

Sp. *Xenodon severus* BOIE, *Coluber severus* L., SEBA *Thesaur.* II. Tab. 24, fig. 1, LINN. *Mus. Ad. Frid.* Tab. 8, fig. 1, Brasil, Surinam;—*Xenodon Merremii* mihi, *Coronella Merremii* SCHLEG., *Liophis* WAGL., MAXIM. *Pr. z.* WIED, *Abbild.* Liefer. VIII. &c.

Heterodon BEAUV., LATR. Rostral scute porrect, erect. Head short, flat. Circle of numerous quadrangular scutes surrounding the eye. Maxillary teeth small, subulate, recurved; posterior upper larger; row of palatine teeth produced almost to the extremity of the external pterygoid bones. Scales carinate. Tail short.

Sp. *Heterodon simus* HOLBR., *Coluber simus* L., CATESBY *Carol.* II. Tab. 56, HOLBROOK *N. Amer. Herpetol.* I. Pl. 26, CUV. *R. Ani., éd. ill., Rept.* Pl. 27, fig. 2;—*Heterodon platyrhinos* HOLBR., *Coluber heterodon* DAUD. *Rept.* Pl. 60, fig. 28, (fig. of head), HOLBR. l. l. II. Pl. 21;—*Heterodon niger* TROOST, CATESBY, II. Pl. 44, HOLB. II. Pl. 23. This last species is *Pelias*

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[1] *Syst. nat.* I ed. 12, p. 387, "*Simillimus Boæ, sed scuta et squamæ capitis majores, ut in Colubris.*"

[2] H. BOIE in the unpublished *Erpétologie de Java*, of which his brother F. BOIE communicated an extract in OKEN'S *Isis*, 1827, s. 508—566.

niger MERR., and has been confounded with *Trigonocephalus* or *Cenchris Mokeson*. Usually the first two species are regarded as varieties, but HOLBROOK considers that they ought to be distinguished as species.

Helicops WAGL. (in part), DUM., BIBR. Head scarcely broader than trunk, covered with small scutes, with anterior frontal scute unpaired. Eyes placed at the anterior and upper part of head. Nostrils perforated in the nasal scute towards its upper part. Two last upper maxillary teeth rather more remote from the rest, larger. Scales carinate. Tail moderate.

Sp. *Helicops carinicaudus* WAGL., *Homalopsis carinicauda* SCHL., *Coluber carinicauda* MAXIM. *Pr. v.* WIED, *Abb. zur Naturgesch. Brasil.* Lief. XI.;—*Helicops angulatus* WAGL., *Homalopsis angulatus* BOIE, SCHLEG. Species from South America, analogous to *Homalopsis*, but without a groove on the large hinder tooth of the upper jaw.

Tropidonotus KUHL, WAGL. Head distinct from trunk, ovato-oblong. Gape of mouth ample. Some posterior teeth in upper jaw longer than the rest, which are moderate, equal. Posterior ocular scutella mostly three. Scales all or the most carinate.

These serpents deserve in the proper sense the name of *Amphibia*, and many seem to prefer a residence in water to that on land. They live on fishes, frogs, &c. Species of this form are found in the temperate and warm countries of the ancient world and in North America.

Sp. *Tropidonotus torquatus* mihi, *Coluber Natrix* L., VAN LIER l. l. Tab. I. STURM *Deutschl. Fauna, Amphib.* Heft III.; the *ringed snake, la Couleuvre à collier, die Ringelnatter*, &c.; the tail forms nearly one-fifth of the whole length, and has commonly between 48 and 68 pairs of scutes; the abdominal scutes are about 170; there is a whitish-yellow collar behind the head; the back is greyish-green, the belly white, with black spots. There are however many varieties of colour in this species; sometimes it is almost quite black. The ringed snake attains a length of 3′; it pairs in June and July, and lays its eggs, about 30 in number, in the autumn, on dunghills and in sheepfolds; it hides underground in winter, in mole-runs, &c. This species is found in almost all the countries of Europe.—*Tropidonotus vittatus, Coluber vittatus* L., *Mus. Ad. Frid.* Tab. 18, fig. 2; BECHST. *Naturgesch. d. Amphib.* IV. Taf. 10; at Java, &c.

Note.—In some species there is a space without teeth in the upper jaw in front of the two or three larger ones. Such are placed by DUMÉRIL and BIBRON in a separate Genus *Amphiesma*, Sp. *Tropidonotus stolatus, Coluber stolatus* L.; and some others; all belonging to the East Indies and the oriental parts of Asia.

Rachiodon JOURDAN, *Deirodon* OWEN. Teeth small, few in the posterior part of jaws; palatine few, very small. Inferior

spinous processes of some of the anterior vertebræ produced into the œsophagus, directed forwards, acute, supplying the office of teeth. Posterior ocular scutes two; frenal scute none. Scales lanceolate, carinate. Tail short.

Sp. *Rachiodon scaber* JOURDAN, *Coluber scaber* L. *Mus. Ad. Frid.* Tab. x. fig. 1, MERR. *Beitr.* 1. Tab. 9, (REINHARDT has given a figure of the Cranium, *Danske Vidensk. Selsk. naturvidensk. og math. Afhandl.* x. 1843, Tab. 1. fig. 24); comp. p. 207, note. This species is from South Africa. LINNÆUS described it as edentulous; such was also the opinion of Dr A. SMITH, who named this genus *Anodon*. This snake lives upon birds' eggs; these, "from the almost edentulous state of the jaws, glide along the mouth nearly unbroken, and it is not until they have reached the gullet and the mouth is closed and prevents the escape of the nutritious matter that the shell is exposed to instruments adapted to its perforation. The shell having been sawed open longitudinally by the vertebral teeth, the eggs are crushed by the contraction of the gullet and carried to the stomach." Comp. OWEN *Odontography*, pp. 220, 221. DUMÉRIL and BIBRON describe another species of this genus, *Rachiodon abyssinus*, *Herpét.* Pl. 81.

Lycodon BOIE, FITZ. Head depressed, narrowed in front of eyes, with snout obtuse. Anterior teeth in both jaws longer than the rest.

Sp. *Lycodon Hebe* BOIE, *Coluber Hebe* DAUD. (and *Coluber aulicus* RUSSELL, 1. Tab. 21, LINN. *Mus. Ad. Frid.* Tab. 12, fig. 2; East Indies).

Note.—Some species have the scutella of the abdominal surface of the tail in a single row (subcaudal scutes undivided). Such is *Lycodon lineatus* REINH. l. l. Tab. 1. fig. 1—9. DUMÉRIL and BIBRON form from these species the genera *Cyclocorus* and *Cercaspis*.

Herpetrodryas BOIE, SCHLEG., *Herpetodrys* WAGL. Head narrow, elongate, rounded towards the apex. Teeth equal, or posterior superior, larger, but not separated from the rest. Eyes large, pupil round. Posterior ocular scutes two, more rarely three. Body compressed. Tail slender, elongate.

Sp. *Herpetodryas carinata* SCHLEG., *Coluber carinatus* L. (and *Coluber fuscus* ejusd.), LINN. *Mus. Ad. Frid.* Tab. 17, fig. 1, MERREM *Beytr.* 1. Tab. x. MAXIM. *Pr. v.* WIED, *Abb.* Liefer. VIII.; in Brasil and Surinam; whilst in all other species of snakes an unpaired row of scales lies on the back, there are in this species two rows of scales in the middle. *Herpetodryas lineata* SCHLEG., *Lygophris lineatus* FITZ., *Coluber lineatus* L. *Mus. Ad. Frid.* Tab. 12, fig. 1, Tab. 20, fig. 1, SEBA *Thesaur.* II. Tab. 12, fig. 3; from Surinam, &c.

This species and some others having the posterior teeth of the upper jaw longer are placed by DUMÉRIL and BIBRON in a separate genus named *Dromicus*. These authors place also *Herpetodryas Helena* SCHLEG., RUSSELL *Serp.* I. Pl. 32, in a separate genus *Plagiodon*, because the teeth of the upper jaw and the palatine teeth are incumbent, with their points directed to the middle (*dentes recumbentes, introrsum directi*).

Dendrophis BOIE, SCHLEG. (in part), DUM. BIBR. (add. *Leptophis* BELL, DUM. BIBR.). Teeth numerous, superior maxillary teeth in a continuous row, equal, or the last larger. Head elongate, narrowed anteriorly, truncate. Eyes large, somewhat prominent. Anterior ocular scute single, posterior two. Nostrils perforated between the two nasal scutes. Body long, slender, angulate below, covered with narrow scales above. Tail slender, very long.

Sp. *Dendrophis liocercus* SCHL., *Coluber Ahætulla* L., *Leptophis Ahætulla* BELL, LINN. *Mus. Ad. Frid.* Tab. XXII. fig. 3, LAC. *Quadr. ovip. et Serp.* II. Pl. 11, fig. 1, MAX. *Pr. v.* WIED, *Abb. zur Naturgesch. Bras.* Lief. XIV.; brown or green above with a metallic lustre; scales carinated, no frenal scute (*scutum loreum*), which exists in all the other species hitherto known, narrow and elongate. The species where the teeth in the upper jaw are all of the same size, and where the median line of the back is covered with a row of longer, hexagonal scales, compose the genus *Dendrophis* in a more strict sense; Sp. *Dendrophis pictus* BOIE, SCHLEG., *Coluber pictus* L. *Mus. Ad. Frid.* Tab. XVII. fig. 2, LAC. *Quadr. ovip. et Serp.* II. Pl. 10, fig. 2, Pl. 11, fig. 2, from the East Indies, &c.

Coluber L. (exclus. of several species). Head elliptic, more or less distinct from trunk, in some scarcely distinct. Gape of mouth moderate. Eyes moderate; pupil round. Posterior ocular scutes two. Scales mostly smooth, more rarely carinate.

Coronella LAUR. (in part), *Zacholus* WAGL., FITZ. Teeth subequal, small, last two upper teeth longer. Nostrils in middle of nasal scute. Trunk cylindric, nearly equal. Tail short. Scales very smooth.

Sp. *Coluber austriacus* GMEL., *Coronella austriaca* LAUR., *Coronella lævis* BOIE, LAURENTI *Specimen*, Tab. V. fig. 1, STURM, *Deutschl. Fauna, Amphib.* Heft 2; in many countries of Europe.

Coluber BOIE, SCHLEG. Teeth equal (*Elaphis* BONAP., DUM., BIBR.) or gradually increasing in upper jaw towards the hinder (*Chorisodon* DUM., BIBR.), continuous, or the larger separated by an interval (*Zamenis* DUM., BIBR.). Nostrils perforated in the suture between the two nasal scutes. Trunk incrassate towards the middle. Tail moderate.

Sp. *Coluber Æsculapii* Lac., Merr. (not L.), *Zamenis Æsculapii* Wagl., Lac. *Quadrup. ovip. et Serp.* II. Pl. 7, fig. 2, Sturm. *Deutschl. Fauna, Amphib.* Heft 2, Cuv. *R. Ani., éd. ill., Rept.* Pl. 30, fig. 1; in the South of Europe; attains a length of more than 4';—*Coluber viridiflavus* Lac., *Coluber atro-virens* Merr., *Hierophis viridiflavus* Fitz., Lac. *Quadr. ovip. et Serp.* II. Pl. 6, fig. 1, *Coluber luteostriatus* C. G. Gmelin *Naturforscher*, VIII. 1799, Tab. III. fig. 2; a prettily marked species also from the south of Europe, &c.

Calamaria Boie. Head small, not distinct from trunk. Gape of mouth small; teeth thin, setaceous. Eyes small. Trunk cylindric, covered with smooth scales. Tail short.

Sp. *Calamaria Linnœi* Boie, *Coluber calamarius* L., *Mus. Ad. Frid.* Tab. VI. fig. 3, Schlegel's *Abbild.* Tab. 4; in the East Indies.

Here are to be placed the sub-genera *Homalostoma* Wagler (Sp. *Calamaria arctiventris* Schleg., *Coluber lutrix* L., *Coluber arctiventris* Merr. *Beitr.* I. Tab. I., a very common little snake from the Cape of Good Hope), *Rhabdosoma* Dum., Bibr. (*Brachyorrhos* Kuhl, Boie in part), *Rhabdion* Dum., Bibr. and *Carphophis* Dum., Bibr. The species with carinated scales form the genera *Elapoides* and *Conocephalus* of Duméril and Bibron. From a species having simple scutes under the tail Wagler has formed the genus *Aspidura* (*Calamaria Scytale* Schl.).

Oligodon Boie. Palatine and pterygoïd teeth none. Maxillary teeth conical, the posterior in upper jaw larger.

Sp. *Calamaria oligodon* Schl., *Oligodon bitorquatus* Boie, Russell *Serp.* II. Tab. 34, Schlegel *Abb.* Tab. 25. *Habitat* Java.

Family X. *Acrochordina.* Spurs none. Head and body covered every where with small scales rhombic, carinate with a sharp crest, arranged quincuncially. (Mental groove none.)

Acrochordus Hornstedt. Head flat, obtuse at the apex, not distinct from trunk. Teeth subulate, recurved, in jaws and palate. Eyes small, distant, often superior, in the anterior part of head. Longitudinal carinate suture of scales along the middle of belly. Tail short.

Sp. *Achrochordus javanicus* Hornst., Lac. *Quad. ovip. et Serp.* II. Pl. 22, fig. 2, (fig. Hornst.), G. I. Kneppelhout *Natuurk. Verh. van de Holl. Maatsch. der Wetensch. te Haarlem.* VIII. 1817, bl. 234—240, Pl. 3, (a very good figure); this species, which appears sometimes to attain a length of 8 feet, is found at Java and Borneo, and lives in water and on land. It was first described by Hornstedt, in 1787, in the *Vetensk. Acad. nye Handl.* The head is very obtuse in front and the tail conical. The cranium presents a very long *os tympanicum* directed backwards, and the under jaw

extends very far backwards. *Acrochordus fasciatus* SHAW, SCHL., *Hydrus granulatus* SCHN., *Chersydrus fasciatus* CUV., *R. Ani., éd. ill., Rept.* Pl. 36 bis, fig. 2; with white transverse bands, which on the back pass into the brown fundamental colour; the tail is somewhat flattened laterally. The eyes are very small; the nostrils lie more upwards; the upper jaw extends beyond the lower with a round margin. This species, smaller than the preceding, is met with at Java, Celebes, Sumatra and Timor.

Xenodermus REINHARDT. Head distinct from trunk, cordate, depressed, scutellate on snout and lips, elsewhere scaly. Abdominal and subcaudal scutes undivided. Body furnished above with minute appressed scales and with a triple longitudinal row of larger scales, gibbous like tubercles. Lateral scales oval, contiguous, not imbricate.

Sp. *Xenodermus javanicus* REINHARDT, *Danske Vidensk. Selskab. Math. og Naturvid. Afhand.* X. Tab. II. figs. 1—8, DUM., BIBR. *Erpétol.* Pl. 63. WIEGMANN, DUMÉRIL and BIBRON place this genus near *Achrochordus*, but REINHARDT believes that there is no true affinity between them. I know this genus only by the descriptions and figures of REINHARDT and DUMÉRIL, and hence it is only with hesitation that I pronounce that this genus might perhaps be placed in the following Family near *Boa* and *Python*.

Family XI. *Pythonina*. Spurs or rudiments of posterior feet (two mobile hooks, one on each side, near the anus). Body covered above with small scales, below with scutes. Subcaudal scutes often entire. Teeth subulate, recurved in jaws and palate.

Eryx DAUD. (excl. of some species), OPPEL, MERR. Head small, covered with granulate scales, anteriorly with a large rostral scute produced beyond the lower jaw and declivous towards mouth. Maxillary teeth small; intermaxillary bone edentulous. Eyes small, surrounded by a circle of small scales; pupil oblong, vertical. Abdominal and subcaudal scutes narrow, in a single row. Tail very short, conical or obtuse. Jugular groove short, sometimes none.

Sp. *Eryx jaculus* DAUD., DUM., *Anguis jaculus* L., HASSELQ., *Boa turcica* OLIVIER, *Voyage dans l'Empire Othoman*, &c. Pl. 16, fig. 2, CUV., *R. Ani., éd. ill., Rept.* Pl. 27, fig. 1; Greece, Tartary, Arabia, Egypt.—*Eryx conicus* DUM., *Boa conica* SCHN., *Eryx bengalensis* GUÉRIN, *Iconogr., Rept.* Pl. 20, fig. 1, RUSSELL *Serp.* I. Pl. 4, and two other species also from the eastern hemisphere. *Eryx Johnii* RUSSELL, which is the largest of all, has rhomboïdal scales raised in the middle, and in this somewhat resembles *Acrochordus*.

Boa L. Head distinct from trunk, flat above, elongato-cordate or oblongo-trigonal, obtuse at the apex, covered with scales or anteriorly with scutes. Eyes moderate. Teeth in intermaxillary bone none. Subcaudal scutes entire. Tail prehensile.

Sp. *Boa constrictor* L., SEBA *Thesaur.* I. Tab. 53, fig. 1, MERR. *Beitr.* II. Tab. 1. CUV. *R. Ani., éd. ill., Rept.* Pl. 26, fig. 3; the head entirely covered with scales, no pit in the marginal scutes of the upper lip. This prettily coloured species, of which the name is in general use as that of a gigantic snake, is, however, by no means the largest species of this family, and seldom attains a length of more than 10 feet; it bears on the east coast of Brasil, according to the Prince MAXIMILIAN VAN WIED, the name of *Jiboya*, as does also the *Boa cenchria* L., MAXIM. *Abb.* Lief. VI., which climbs trees and never lives in water; this species has scutes on the head and little grooves at the margin of the upper jaw. The largest species, on the contrary, is *Boa murina* L., *Eunectes marinus* WAGL., *Boa aquatica* MAXIM. *Abb.* Lief. II, *Boa aboma* DAUD. *Rept.* V. Pl. 62, fig. 2, Pl. 63, fig. 2, which attains a length of more than 20'; it resides much in water, and, besides fish, lives also on mammals that come to the banks of rivers to drink. A very beautifully coloured species, blue-green with white bands, has a compressed body: *Boa canina* L., (*Xiphosoma caninum* WAGL.), *Mus. Ad. Frid.* Tab. 3, LAC. *Quadr. ovip. et Serp.* II. Pl. 17, fig. 1, GUÉR. *Iconogr., Rept.* Pl. 19, fig. 2. All these species are found in South America. There are also, however, some species in the eastern hemisphere; *Boa carinata* SCHN., *Enygrus carinatus* WAGL., from the island Amboyna and New Guinea, and *Enygrus Bibroni* DUMÉR. from the island Viti or Fejee, with scales carinate and larger than in the other species, where they are usually very small. Also there is a *Boa* of the division or the sub-genus *Xiphosoma*, and another species that lives in water from which DUMÉRIL and BIBRON form their genus *Pelophilus*, which have been observed on the Island of Madagascar.

Note.—On the divisions of this genus, to which almost 20 species belong, into numerous sub-genera (*Enygrus* WAGL., *Leptoboa* DUM., BIBR., *Tropidophis* DUM., BIBR., *Eunectes* WAGL., &c.) compare DUM., BIBR. *Erpétol.* VI. pp. 474—566.

Platygaster DUM. and BIBR., *Uroleptis* FITZ. Head scutate, conical, scarcely distinct from body. Scales carinate. Ventral and subcaudal scutes broad. (Pits at lips none. *Habitus* of *Coluber*.)

Sp. *Boa pseudo-eryx* nob., *Platygaster multicarinatus* DUM. and BIBR., *Tortrix pseudo-eryx* SCHLEGEL, *Abbild.* Tab. 34, New Holland.

Python DAUD. (Spec. of *Coluber* L.) Teeth in intermaxillary bone four. Head distinct from trunk, elongate, truncate, anteriorly scutate, posteriorly often scaly. Tail prehensile, with all or most of the scutes below in pairs. Scales small, smooth.

a) *Pits on each side in the posterior scutes of lower lip, in scutes of upper lip none.*

Bothrochilus FITZ., *Nardoa* GRAY, DUM. and BIBR.

Sp. *Python Schlegelii, Nardoa Schlegelii* GRAY, *Tortrix Boa* SCHLEG. *Abb.* Tab. 13; discovered at New Ireland by LESSON and GARNOT.

b) *Pits in scutes of both lips.*

Python DAUD.

† *With head almost entirely scutate above.*

Sub-genus *Liasis* GRAY, DUM. and BIBR. Sp. *Python amethystinus* DAUD., MERR.; Moluccan Islands, New Ireland.

†† *With head anteriorly scutate.* (*Nostrils in the suture of two nasal scutes.*)

Sub-genus: *Python* DUM. and BIBR.

Sp. *Python molurus* GRAY, *Coluber molurus* L., *Python tigris* DAUD., LAC. *Quadr. ovip. et Serp.* II. Pl. 10, fig. 1, SEBA *Thesaur.* I. Tab. 37, fig. 2, RUSSELL *Serp.* I. Pl. 22, 23, 24, 39; Bengal, Java. This species becomes 20 feet long, as does a species from the coast of Guinea, very similar in marking and confounded with it, *Python Sebæ* DUM. and BIBR., *Coluber Sebæ* GMEL. (*Python bivittatus* KUHL, *Python hieroglyphicus* MERR.), SEBA *Thesaur.* II. Tab. 19, fig. 1, 27 fig. 1, 99 fig. 2, DUM. and BIBR. *Erpétol.* Pl. 61;—*Python Schneideri* MERR., SCHL., *Python reticulatus* GRAY, SEBA *Thesaur.* II. Tab. 79, fig. 1, Tab. 80, fig. 1, GUÉR. *Iconogr., Rept.* Pl. 21, fig. 1; Sumatra, Java, Borneo, also on the continent of India; this prettily marked species is more slender than the two preceding, but becomes, like them, 20 or more feet long.

††† *With head short, broad, almost entirely scaly.* (*Nostrils in single nasal scute.*)

Sub-genus: *Morelia* GRAY, DUM. and BIBR.

Sp. *Python Peronii* CUV., SCHL., *Coluber argus* L., *Seba Thesaur.* II. Tab. 103, fig. 1, CUV. *R. Ani., éd. ill., Rept.* Pl. 28, and GRIFFITH and PIDGEON *Reptiles, Animal Kingdom,* IX. opposite to p. 331; New Holland. No species of *Python* from America is known, where this genus is replaced by *Boa.*

B. *Stenostomi* (see above p. 256).

Gape of mouth small. Mastoïd bone concrete with the other bones of the skull; quadrate bone short. Mental groove in some none, in others short.

Family XII. *Cylindrophes* s. *Tortricina.* Head scutate, not distinct from trunk. Teeth in jaws and palate. Eyes small.

Trunk cylindric, covered above with smooth, imbricate scales. Abdominal and subcaudal scutes narrow.

Ilysia HEMPR., FITZ., LICHTENST. (*Tortrix* OPP., CUV., MERR.). Maxillary teeth conical, thick, curved backwards; palatine teeth less. Spurs at the vent, contained in a cavity open by a small foramen on each side near the vent. Abdominal scutes small, scarcely distinct from scales. Tail very short, below, with scutes undivided.

Cylindrophis WAGL., DUM. and BIBR. Eyes surrounded by scutes. Intermaxillary bone edentulous.

Sp. *Ilysia maculata* LICHTENST., *Anguis maculata* L., *Mus. Ad. Frid.* Tab. 21, fig. 3, GUÉR. *Iconogr., Rept.* Pl. 19, fig. 1, Ceylon; *Ilysia rufa* LICHTENST., *Tortrix rufa* MERR., SEBA *Thesaur.* II. Tab. 25, fig. 1, &c., Java, Borneo, Bengal.

Ilysia WAGL., *Tortrix* DUM. and BIBR. Eyes in the middle of scute. Intermaxillary bone furnished with teeth.

Ilysia scytale HEMPR., *Anguis scytale* L., SEBA *Thes.* II. Tab. 73, fig. 3, LINN. *Mus. Ad. Frid.* Tab. VI. fig. 2, SCHLEGEL *Abbild.* Tab. 33, fig. 1, cranium, figs. 2—4, *Dict. univ. d'Hist. nat., Rept.* Pl. 8, fig. 1; Surinam, a very common species in collections.

Note.—That the name *Tortrix* OPPEL (*Die Ordnungen, Familien und Gattungen der Reptilien*, München, 1811, p. 55) should be changed for *Ilysia*, is recommended by the more familiar use of the same name in Entomology, already authorised by LINNÆUS. See above, Vol. I. p. 395.

Xenopeltis REINW. Head depressed, narrowed anteriorly, truncated. A second vertebral scute interposed between the two occipital scutes resembling large scales. Upper jaw protracted beyond lower. Teeth setaceous, sharp, numerous, set upon intermaxillary bone, both jaws and palate-bones (superior maxillary bone thin, styliform). Scales flat, broad, hexagonal, subimbricate. Spurs at vent none. Tail short, conical, covered below by divided scutes.

Sp. *Xenopeltis unicolor* REINW. (and *Xen. leucocephala*), *Tortrix Xenopeltis* SCHLEG. *Abb.* Tab. 35, GUÉR. *Iconogr., Rept.* Pl. 21, fig. 3, (the head). From the Sunda Isles.

Family XIII. *Rhinophes* s. *Hyperolia.* Head scutate, not distinct from trunk, small, with snout acuminate. Maxillary teeth; palatine teeth none. Eyes small, occupying the middle of

the covering scute. Scales smooth, tetragonal, broader in the middle abdominal row, resembling scutellæ. Tail very short, truncated, with a horny disc descending obliquely from the upper part, or covered at the apex with carinate scales. Gular groove none. Rudiments of pelvis none.

This small family, to which also two new genera of DUMÉRIL and BIBRON belong, *Coloburus* and *Plectrurus* still unknown to me, was placed by CUVIER with *Tortrix*, and by SCHLEGEL was referred to the genus *Typhlops*. The characteristics of external structure and the osteological peculiarities have been investigated by J. MUELLER; see *Zeitsch. für Physiol. von* F. TIEDEMANN *u.* TREVIRANUS, IV. s. 248—253. Compare a figure of the same in DUMÉRIL and BIBR. *Erpét.* Pl. 76. fig. 1.

Uropelta. (*Uropeltis* CUV., add *Rhinophis* HEMPR., *Pseudotyphlops* SCHL.).

Sp. *Uropelta ceylonica* CUV. *R. Ani.* II. *éd.* 2, p. 76, Pl. VII. fig. 2, COCTEAU, GUÉRIN *Magas. de Zool.* 1833, *Rept.* Pl. 2;—*Uropelta Philippina* CUV., EYDOUX *et* GERVAIS in GUÉRIN *Magas. de Zool.* 1837, *Rept.* Pl. 13.

Note.—*Coloburus* is distinguished by an oblique truncated tail, covered at the truncation with bicarinate scales.

Family XIV. *Typhlina* (*Hopoterodonta* DUMÉR.). Head not distinct from trunk, mostly scutate. Mouth small, inferior. Teeth few, in one or other of jaws (mostly none below). Eyes minute, covered by scute. Scales very smooth, imbricate, covering body everywhere. Gular furrow none. Tail very short, conical, mostly acuminate with a terminal scale resembling a spine. Rudiments of pelvis, styliform ossicles covered by skin (placed in front of vent).

In these small serpents, resembling earth-worms, the anterior part of the cranium is broad, expanded like a vesicle in front; the short under jaw consists of two lateral pieces united in the middle by an elastic ligament. The upper jaw-bones (or the bones which MUELLER regards as palate-bones) are short and armed with a few (at most five) teeth; the under jaw commonly has no teeth, but, if it be provided with them, the teeth are absent in the upper jaw, and the upper jaw-bones are in that case thin. See J. MUELLER *op. cit.* s. 241—245, Taf. 20, fig. 10—15, DUM. and BIBR. *Erpét.* VI. p. 241—249, Atl. Pl. 75, figs. 1, 2. The head has mostly in front a large *scutum rostrale* which is bent downwards, and in many the nostrils are situated on the under

surface of the snout prolonged above the mouth. Most of the species are from America, but some others are also met with in the Indian Archipelago. One species occurs in Greece and in Western Asia.

Typhlops SCHN., CUV., MERR., SCHLEGEL.

Note.—Characters of the family. The author of the genus is J. G. SCHNEIDER, *Hist. Amphib.* II. 1801, p. 339.

A. *With teeth in lower jaw; upper jaw edentulous.*

Catodon DUM., BIBR. Head depressed. Eyes subindistinct.

Stenostoma DUM., BIBR. Head round, rotundate. Eyes distinct.

Sp. *Typhlops nigricans* SCHL., *Abb.* Tab. 32, figs. 21—24; Cape of Good Hope;—*Typhlops undecim-striatus* CUV., *Stenostoma albifrons* DUM.; Brasil, &c.

B. *With lower jaw edentulous.*

† *With head scaly.*

Cephalolepis DUM. and BIBR.

Sp. *Typhlops squamosus* SCHLEG. *Abb.* Tab. 32, figs. 9—12, Cayenne.

†† *With head scutate.*

a) *With nostrils lateral.*

Cathetorhinus DUM. and BIBR.

Typhlops DUM. and BIBR.

Sp. *Typhlops reticulatus* CUV., GRAY, *Anguis reticulata* L., *Typhlops lumbricalis* SCHLEG. *Abb.* Tab. 32, figs. 1—4; BERTHOLD *Neue oder seltene Amphibienarten*, Göttingen, 1842, p. 8, Tab. I. figs. 1—3, *Dict. univ. d'Hist. nat., Rept.* Pl. VII. fig. 3 (under the name of *Typhlops lumbricalis*), DUM. *et* BIBR. *Erpét.* Pl. 60; Surinam, the largest species of this family;—*Typhlops Richardii* DUM., *Typhlops cinereus* GUÉR., *Iconogr., Rept.* Pl. 18, fig. 2, Antilles;—*Typhlops vermicularis* MERR., *Typhlops flavescens* LAC. *Quadr. ovip. et Serp.* II. p. 455, Pl. 20, fig. 1; Morea, Island of Cyprus, Georgia, &c.

b) *With nostrils inferior.*

Typhlina WAGL., *Pilidion* DUM. and BIBR. With eyes not conspicuous.

Ophthalmidion DUM. and BIBR.

Onychocephalus DUM. and BIBR. Eyes conspicuous. Rostral scute produced above the head into an elliptic flat disc.

Sp. *Typhlops Delalandii* Mus. Par. L. B., SCHLEG. *Abb.* Pl. 32, figs. 17—20, Cape of Good Hope;—*Onychocephalus nigrolineatus* HALLOWELL, *Journal of the Academy of nat. Sc. of Philad.* Sec. Ser. II. p. 301, Pl. 28, fig. 1, Liberia.

TRIBE II. *Amphicephali.*

Tongue short, thick, posteriorly bilobed, anteriorly with apex double, narrow, very short. Branches of lower jaw conjoined anteriorly by symphysis.

If the separation of the lower jaw, and the narrow, forked, extensile tongue be made the characteristic of the order of serpents, then the genus *Amphisbæna* ought to be removed from it, and placed amongst the lizards. This is the opinion of modern authors, and may in fact be justified by the resemblance between some lacertine animals (*Ophisaurus, Pseudophis*) and *Amphisbæna.* The row of pores in front of the cloacal aperture corresponds to the *pori femorales* which are met with in many *Saurii.*

Family XV. *Amphisbænæ* WIEGM. Teeth in intermaxillary bone, in upper and lower jaw-bones; upper and lower teeth alternating and interlocking when the mouth is closed; palatine and pterygoïd bones edentulous. Trunk cylindric; skin ringed with numerous deep, circular folds; rings divided by longitudinal inscriptions into small rectangular areas resembling scales. Head scutate. Eyes small, covered by scute. Tail short.

Amphisbæna L. Feet none.

a) *Teeth concrete with jaws.*

Trogonophis KAUP, FITZ., DUM. Anal pores none. Tail conical.

Sp. *Amphisbæna Wiegmanni* nob., *Trogonophis Wiegmanni* KAUP, *Isis* 1830, p. 880, Tab. 8, fig. 1, *Amphisbæna elegans* GERVAIS, GUÉRIN *Magas. de Zool.* 1837, *Rept.* Pl. 11; yellow, with red brown, four-sided spots, arranged like a chess-board; this species occurs on the north coast of Africa.

b) *With teeth adhering internally to the margin of jaws.*

Lepidosternon WAGL. Head short, conical. Anal pores none. Tail round, obtuse. Some larger, irregular scutes, behind the throat.

Sp. *Amphisbæna microcephala* nob., *Lepidosternum microcephalum* WAGL., *Amphisbæna punctata* MAXIM. *Pr. v.* WIED (not BELL), *Abb. zur Natur-*

gesch. Bras. Lief. IX. Brasil;—*Amphisbæna scutigera* HEMPR., also from Brasil; resembling an earth-worm; it is distinguished from the other species by two large scutes, which cover the head. MUELLER formed of it a distinct genus, *Cephalopeltis; Zeitschr. f. Physiol. von* TIEDEM. *u.* TREVIR. IV. 2, p. 253, Tab. 22, fig. 5. Compare on the sub-genus *Lepidosternon*, WIEGMANN in his *Archiv f. Naturgesch.* 1836, I. pp. 152—158.

Amphisbæna DUM. and BIBR. (*Amphisbæna* and *Blanus* WAGL.). Head obtuse, gibbous. Row of pores in front of vent.

Sp. *Amphisbæna alba* L., *Mus. Ad. Frid.* Tab. IV. fig. 2, LAC. *Quadr. ovip. et serp.* II. Pl. 21, fig. 1, *Amphisbæna flavescens* MAXIM. *Pr. v.* WIED, *Abb. zur Naturgesch. Bras.* Lief. IX.; yellow or reddish brown on the back, white below; the largest species, becomes 1′ 9″ long, of which the tail makes one half, with twenty rings; Surinam, Brasil;—*Amphisbæna fuliginosa* L., SEBA *Thes.* I. Tab. 88, fig. 3, II. Tab. 73, fig. 4, Tab. 100, fig. 3, CUV. *R. Ani., éd. ill., Rept.* Pl. 25, fig. 1, (on the plate fig. 2 erroneously stands by the figure); this species from Guiana and Surinam is spotted irregularly yellow and black; it is smaller than the preceding, and the tail has from 26 to 30 rings, without being longer on that account.—In these and some other species the tail is blunt; *Amphisbæna cinerea* VANDELLI, *Blanus cinereus* WAGL., GERVAIS in GUÉRIN, *Magas. de Zool.* 1837, *Rept.* Pl. 10, from Portugal, Spain and North Africa; is distinguished by a conical, pointed tail.

Chirotes DUM., CUV., MERR. Limbs two anterior, short, placed near the head, with hand broad, pentadactylous, four fingers unguiculate, subequal, fifth very small, clawless. Row of pores in front of vent.

Sp. *Chirotes canaliculatus* MERR., *Lacerta lumbricoides* SHAW, LAC. *Quadr. ovip. et Serp.* I. Pl. 41, DAUD, *Rept.* IV. Pl. 58, fig. 4, GUÉRIN *Iconogr., Rept.* Pl. 16, fig. 3; a small animal, 8″ or 9″ long, which is found in Mexico. CUVIER had announced that it agrees with *Amphisbæna* in internal structure and ought to be placed near it: this has been confirmed by the investigations of J. MUELLER, and is now generally received; see *Zeitschr. f. Physiol.* cited above, pp. 257—260, where also the skeleton and the tongue are figured.

ORDER V. *Saurii.*

Cavity of tympanum distinct, covered in most by a naked tympanic membrane, in some by strata of muscles. Eyelids mostly distinct, mobile. (Lower jaw with symphysis immoveable. Maxillary teeth in all, in some palatine teeth also. Feet almost always four, in some two posterior, in very few none.)

This most numerous order of reptiles contains some species which correspond externally with serpents to such a degree, that formerly,

and even in the beginning of the present century, they were united therewith. The rest, with the exception of the small genus *Draco*, were all referred by LINNÆUS to the genus *Lacerta*, which, however, also contained the tailed species of *Diplopnoa* which were known to him. We divide this order into two principal groups, of which the second contains the family of the crocodiles alone, the first and largest group all the remaining *lacertine animals*.

TRIBE I. *Squamati*.

Teeth concrete at their base with jaws or adhering to the internal margin of jaws. Cloacal fissure transverse. Penis double. Body covered with scales.

Family XVI. *Scincoidei*. Tongue not extensile, flat, with apex mostly emarginate or bifid. Head scutate. Body everywhere covered with imbricate scales. Feet short, often imperfect, sometimes none. Femoral pores none.

Of this family only a small number of species occur in our quarter of the world; they are most numerous in Asia and the Indian Archipelago, on the islands of the southern Pacific and in New Holland. They are for the most part small animals, of which some few attain a length of 1′; very few which become more than 1½ feet long, may be regarded as gigantic forms in this family.

The whole body is covered with scales that lie over one another in the fashion of roof-tiles, like the scales of a carp. Only very few have teeth in the palate; we shall indicate the cases in which these teeth occur when characterising the genera.

Acontias CUV. Teeth short, conical. Apex of snout masked by a broad scute. Nostrils very minute, cut in rostral scute above. Body elongate, serpent-like. Feet none, or very short vestiges of hind feet. Tail short, with apex rounded, obtuse.

a) *With eyes latent under the skin, very small.*

Dibamus DUM. and BIBR. Rudiments of hind feet small, flat, adactylous, scaly.

Sp. *Acontias subcœcus*, MUS. L. B., *Dibamus Novæ Guineæ* DUM. and BIBR.; a small animal of New Guinea met with also at Celebes; the small eyes are distinctly visible under the skin.

Typhline WIEGMANN. Rudiments of feet none. Groove behind the nostrils on each side in rostral scute.

Sp. *Typhline Cuvieri* WIEGM., *Acontias cæcus* CUV., Cape of Good Hope.

b) *With eyes small, naked; eyelid single, inferior, short.*

Acontias WIEGM., DUM. and BIBR. Rudiments of feet none. Groove behind the nostrils on each side in rostral scute.

Sp. *Acontias meleagris* CUV., *Anguis meleagris* L., SEBA *Thes.* II. Tab. 21, fig. 4, GUÉRIN *Iconogr., Rept.* Pl. 17, fig. 3, DUM. and BIBR. *Erpétol.* Pl. 58; from the Cape of Good Hope.

Anguis CUV. (Species from gen. *Anguis* L.). Feet none. Eyes furnished with eyelids mobile, opening by a longitudinal aperture. Aperture of auditory passage very small, scarcely distinguishable or concealed under scales. (Sternum, clavicle and scapula; rudiments of posterior extremities latent under the skin.)

a) *With teeth conical, straight.* Nostrils placed in the suture between two scutes, (*Ophiomorus* DUM. and BIBR.). Sp. *Anguis miliaris* PALL., GMEL.; in the Crimea, the Morea, and also in Africa.

b) *With teeth subulate, long, recurved.* Nostrils perforated in the middle of scute, (*Anguis* DUM., BIBR.). Sp. *Anguis fragilis* L., LAURENTI *Specimen*, Tab. V. fig. 2, VAN LIER *Slangen*, Tab. III., WOLF in STURM'S *Fauna, Amphib.*, Heft III., BELL *Brit. Rept.* p. 41; the *blind-worm, slow-worm, die Blindschleiche, l'Orvet;* the back mostly copper-coloured or brownish with a silvery glance; sometimes with a longitudinal black stripe on the middle; the belly is bluish. This species grows to a length of full 1′ (or sometimes 15″) and to a thickness of 6‴; the tail, which is variable in length (often as long as the trunk), is easily broken off. *Anguis lineata* LAUR., *Anguis lineatus* WOLF (STURM'S *Fauna* l. l.), is a younger individual of the same species. The slow-worm is *viviparous*, feeds on slugs, insects and earth-worms, hides in winter underground and then becomes torpid. It is found in almost every country of Europe, in the west of Asia, and the north of Africa.

Hysteropus. Vestiges of hind feet very short, undivided, scaly; anterior feet none. Eyes destitute of eyelids, covered with a transparent capsule. Row of pores in front of vent. Scales carinate.

Sp. *Hysteropus novæ Hollandiæ* DUM., *Bipes lepidopus* LAC. *Ann. du Mus.* IV. Pl. 55, fig. 1, GUÉRIN *Iconogr., Rept.* Pl. 16, fig. 4, CUV. *R. Ani., éd. ill., Rept.* Pl. 22 *bis*, fig. 2, New Holland.

Ophiophthalmus FITZ., *Lialis* GRAY. (Characters of preceding genus. Scutella of head small, irregular; head above flat, smooth,

narrow, triangular. Nostrils perforated in the single nasal scute, at the apex of snout. Tongue with apex bifid. Scales smooth.)

Sp. *Ophiophthalmus Burtonii, Lialis Burtonii* GRAY, *Proceed. of the Zool. Soc.* 1834, p. 134; New Holland.

Ophiopsis FITZ., *Lerista* BELL. Feet four, anterior didactylous, very short, posterior tridactylous. Eyes destitute of eyelids, covered by a transparent capsule. Body slender. Pores in front of vent none.

Sp. *Ophiopsis lineata, Lerista lineata* BELL, *Proceed. of the Zool. Soc.* 1833, p. 99; New Holland. This species is unknown to me.

Gymnophthalmus MERR. Feet four, anterior tetradactylous, posterior pentadactylous. Eyelids none; transparent capsule over eyes.

Sp. *Gymnophthalmus quadrilineatus* MERR., *Lacerta quadrilineata* L., MAXIM. *Abb. zur Naturgesch. Bras.* Lief. XIII. (*Rept.* Tab. XVII. fig. 2); a small species from South America.

Cryptoblepharus WIEGMANN, *Ablepharus* FITZ. Feet four, pentadactylous. Eyes with a circular or lunate rudiment of eyelids, further covered by a transparent capsule.

Sp. *Cryptoblepharus pannonicus* nob., *Ablepharus pannonicus* FITZ., *Verhandl. der Gesellsch. der naturforsch. Freunde zu Berlin*, I. 1829, Taf. XIV. *Ablepharus Kitaibelii* GRAVENHORST, *Nov. Act. Acad. Leop. Car.* XXII. 1, 1851, Tab. 37; Hungary; in this species the limbs are shorter than in the others of this small genus, of which one is remarkable on account of its extensive geographic distribution, namely *Ablepharus Peronii* DUM., BIBR., *Ablepharus pœcilopleurus* WIEGMANN, *Nov. Act. nat. Curios.* XVII. 1835, Tab. 8, fig. 1, *Ablepharus Leschenault* COCTEAU, GUÉR. *Magas. de Zool.* 1832, *Rept.* Pl. 1; it occurs in the Morea, in Africa on the coast of Mozambique, at the Sunda Islands, at New Holland, and the Sandwich Islands.

Bipes MERR. (Species from gen. *Bipes* LAC., CUV.), *Scelotes* FITZ. Rudiments of hind feet only. Eyes provided with mobile eyelids. Body elongate, anguineous.

a) *Rudiments of hind feet adactylous, clawless, styliform.*

Ophiodes WAGL., *Pygodactylus* FITZ.

Sp. *Bipes striatus* nob., *Pygopus cariococca* SPIX, a small species from Brasil and Guiana.

Præpeditus DUM., BIBR., *Soridia* GRAY.

Sp. *Bipes lineatus* nob., *Soridia lineata* GRAY; also very small, silver-coloured, two brown longitudinal stripes and darker spots on the back in two rows. This species occurs in New Holland, (see GRAY *Annals of Nat. Hist.* VII. 1841, p. 86), whence also the specimen in the Leyden Museum was received from the traveller PREISS.

b) *Rudiments of hind feet didactylous, with toes unequal, unguiculate.*

Scelotes FITZ.

Sp. *Bipes anguineus* GRAY, *Anguis bipes* L., *Mus. Ad. Frid.* Tab. 28, fig. 3, *Seps Gronovii* DAUD. *Rept.* IV. Pl. 58, fig. 2, from the Cape of Good Hope.

Brachymeles nob. (*Brachymeles* DUM. and BIBR., *Chelomeles* eorumd., *Brachystopus* eorumd., *Evesia* GRAY). Rudiments of four feet very short, monodactylous or didactylous. Eyelids mobile. Aperture of auditory meatus very small or none. Body anguineous, with scales short.

Evesia GRAY. Rudiments of feet styliform, undivided, covered with scales. Snout masked by scute.

Brachystopus DUM., BIBR. (*Rhodona* GRAY). Rudiments of fore feet conical, undivided, of hinder didactylous, with toes unguiculate.

Brachymeles DUM. and BIBR. Rudiments of fore feet didactylous, with toes unguiculate, of hinder undivided. Aperture of auditory meatus none.

Chelomeles DUM. and BIBR. Fore and hind feet didactylous.

Sp. *Brachymeles didactylus* nob., *Chelomeles quadrilineatus* DUM. and BIBR.; from New Holland; this species is the only one of this division that I have been able to observe myself. Compare on these sub-genera GRAY *Ann. of Nat. Hist.* II. pp. 335, 336, and DUM. and BIBR. *Erpét.* V. pp. 774—783.

Seps DAUD. (exclusive of some species). Feet very short, with three or four toes unguiculate. Apex of tongue emarginate. Teeth conical, numerous. Eyelids mobile. Body anguineous; tail conical, acuminate. Scales smooth.

a) *Nostrils situated between nasal and rostral scute. Feet (posterior or all) tridactylous.*

Sp. *Seps chalcidica* MERR., *Lacerta chalcides* L. (in part), *Seps tridactylus* DAUD. *Rept.* IV. Pl. 57, *Seps striata* GUÉRIN *Iconogr., Rept.* Pl. 15, fig. 3, CUV. *R. Ani., éd. ill., Rept.* Pl. 22 *bis*, fig. 1, *Seps tridactylus, Diss. inaug. auctore* B. F. SICHERER, *cum icone color.*, Tubingæ, 1825, 4to; 10″ to 1′

long; bronze-coloured, usually with four longitudinal darker stripes; belly greenish-white; this animal is viviparous, and is found in Spain, Italy and Dalmatia. A very similar species, which has only two toes on the fore feet, is met with in North Africa (*Heteromeles mauritanicus* DUM., BIBR.), where also (at Algiers) the preceding has been found.

b) *Nostrils situated in nasal scute.*

Hemierges WAGL. (with feet tridactylous).

Tetradactylus PÉRON, DUM., BIBR. (Comp. DUM. *et* BIBR. *Erpétol.* v. pp. 763—767).

Scincus GRONOV, LAUR., DAUD., MERR. Feet four, low, pentadactylous (in a few posterior or anterior alone pentadactylous, the others tetradactylous). Tongue emarginate at the apex, beset with scaly papillæ. Eyelids mobile. Teeth subulate in jaws; in most the palate edentulous. Aperture of auditory meatus in all mostly distinct, an oval or oblique chink behind the angle of mouth, surrounded by small scales. Tail conical.

a) *With toes round.*

Gongylus DUM. and BIBR. (with addit. of some others; *Gongylus* WAGL., *Eumeces* WIEGM., *Euprepes* WAGL., *Plestiodon* DUM. and BIBR., *Lygosoma* GRAY, *Leilepisma* DUM. and BIBR., *Tropidolepisma* DUM. and BIBR., *Heteropus* FITZ., *Campsodactylus* DUM. and BIBR.). Snout conical. Tongue all scaly. Palatine teeth in some.

Sp. *Scincus brachypus* SCHNEID., MERR., *Lygosoma brachypoda* DUM., BIBR., *Anguis quadrupes* L. and *Lacerta chalcides* L. (in part), VOSMAER *Afrikaansche gladgeschubde wormhagedis*, 1774; this small species, with very short five-toed feet, is not from Africa, as VOSMAER supposed, but from the Island Java. CUVIER referred this species to the genus *Seps;* the auditory apertures are very small, and were not remarked by LINNÆUS (*Syst. nat. ed.* 12, I. p. 390). Compare also BLOCH *Beschäftigungen der Berlin. Gesellsch. naturforsch. Freunde,* II. 1775, s. 28—34, Tab. 2.

Scincus ocellatus DAUD., MERR., *Gongylus ocellatus* DUM., BIBR., *le mabouya* LAC., *Quadr. ovip. et Serp.* I. Pl. 24, OLIVIER *Voyage dans l'Emp. Othoman*, Pl. 16, fig. 1, DAUD. *Rept.* IV. Pl. 56; Sardinia, Sicily, Algiers, Egypt. Comp. G. DE NATALE *Ricerche anat. sullo Scinco variegato*, c. 2 Tavole, *Accad. delle Sc. di Torino. Classe di Sc. Fis. e Math.* 2da Serie, Tom. XIII. 1852, p. 436 and seq.

Scincus campsodactylus nob., *Campsodactylus Lamarrei* DUM. and BIBR.; from the continent of the East Indies; five toes on the fore feet, four on the hind feet. In two other species conversely the fore feet are provided with four toes, the hind feet with five; they form the genus *Heteropus* DUM.

Amphiglossus DUM. and BIBR. Snout conical. Tongue smooth anteriorly, posteriorly beset with papillæ scaly, imbricate, reversed. Scales smooth.

Diploglossus WIEGM. Snout conical. Anterior part of tongue covered with scales, posterior with filiform papillæ. Scales marked with several exsert striæ.

Sp. *Scincus fossor* MERR., *Diploglossus Shawii* DUM., *Gallywasp* BROWNE, *Jamaica* (and SLOANE *Voy. to Jamaica*, Tab. 273, fig. 9?); a very large species from the West Indies;—*Scincus Houttuynii*, *Diploglossus Houttuynii* COCT., CUV. *R. Ani., éd. ill., Rept.* Pl. 21, fig. 2.—*Euprepes fasciata* REUSS, *Mus. Senckenberg.* I. Tab. 3, fig. 2; Brasil.

Sphenops WAGL. Snout cuneiform, upper jaw with flat margin exsert beyond the lower. Feet small, distant, anterior with short toes. Scales smooth. Tail long.

Sp. *Scincus capistratus* SCHREIB., *Scincus scincoides* AUD., SEBA *Thes.* II. Tab. 12, fig. 6? DUM. *Erpétol.* V. Pl. 57, fig. 3, (figure of head); Egypt.

b) *With toes depressed, serrate at the margin.*

Scincus FITZ., DUM. and BIBR. Snout cuneiform; upper jaw produced beyond lower, with margin acute. Teeth in palate. Tail short, thick at the base, conical, acuminate. Scales smooth.

Scincus officinalis LAUR., *Lacerta scincus* L., LAC. *Quadr. ovip. et Serp.* I. Pl. 23, BLUMENB. *Abb. naturh. Gegenst.* No. 87, BRANDT u. RATZEB. *Mediz. Zool.* I. Tab. 19, fig. 2; the *Scinc.* This species lives in Egypt and some other countries of Africa; when in danger it endeavours to bury itself quickly in the sand. This little animal is used by the Orientals as a special excitant (*aphrodisiacum*). The *Scincus* of the ancients, on which compare PLINIUS (*Hist. nat.* Lib. 28, c. 8), was, according to PROSPER ALPINUS, an entirely different animal, probably a *monitor*, as CUVIER also supposes. In the time of GESNER water-salamanders also were sold in place of scincs; C. GESNERI *Hist. Anim.* Lib. II. p. 24.

Cyclodus WAGL. Four short feet, subequal, pentadactylous, with toes round. Tongue emarginate, covered with scaly papillae. Eyelids mobile. Teeth rounded at the apex, posteriorly subglobose. Palate edentulous. Head flat, distinct from trunk by stricture. Nostrils in nasal scute, mostly furnished with a bent groove behind the aperture. Oblique chink of auditory meatus, situated behind the angle of mouth. Scales large. Tail shorter than trunk.

Sp. *Cyclodus Boddaertii* DUM. and BIBR., *Scincus gigas* BODDAERT, *Nov. Act. Acad. nat. curios.* VII. p. 5, WHITE *Journal of a Voy. to New South Wales*, p. 242, Pl. 30; New Holland and Amboyna.

Strobilolepis nob., *Trachysaurus* GRAY, DUM. and BIBR. Scales gibbous, or subcarinate, thick. Tail very short, depressed. Remaining characters nearly of genus *Cyclodus*.

Sp. *Cyclodus pachyurus, Trachysaurus rugosus* GRAY, *Trachysaurus Peronii* WAGL., New Holland.

Tropidophorus DUMÉR. and BIBR. (*Leposoma* CUV. not SPIX, *Tropidosaurus* GRAY not BOIE.) Four feet pentadactylous, with toes unequal, subcompressed. Eyelids mobile. Maxillary teeth cylindrical, palatine none. Tongue emarginate, covered with scaly papillæ. Membrane of tympanum naked. Back flat with carinate scales. Tail compressed.

Sp. *Tropidophorus cocinsinensis, Tropidosaurus montanus* GRAY, DUM. *et* BIBR. *Erpét.* v. Pl. 57, fig. 1; this species from Cochin China, discovered by DIARD, from whence also the specimen in the Leyden Museum is derived, differs by the tympanic membrane lying bare and also by its general form, in a remarkable manner from the rest of the Scincs. CUVIER placed this genus with *Agama* amongst the Iguanoïds.

Family XVII. *Zonosauri* nob. s. *Ptychopleurœ* WIEGM. (*Cyclosauri* DUM. and BIBR. in part). Tongue not extensile, flat, oblongo-triangular, emarginate at the apex. Head scutate, flat above, separated from the nape by a transverse groove. Scales verticillate, in back mostly subquadrate, or rectangular. Feet sometimes none or vestiges only of hinder. Eyelids mobile, distinct. (Femoral pores in many. A longitudinal fold on each side of the abdomen in almost all.)

A small family, of which some species were formerly placed amongst the Iguanoïds, whilst others which had no limbs or imperfect limbs, were arranged in the neighbourhood of *Anguis* and *Bipes*, or united to them. The belt-like covering of scales distinguishes these lacertine animals from all the rest.

This is the fittest place to say a few words on the *pori femorales*. In many lizards on the inside of the thighs is found a row of tubercles with an aperture into which the cuticle penetrates. In *Amphisbœna* and *Chirotes* we have already noticed the presence of similar apertures in front of the vent. The scales in which these little pits are situated often differ somewhat in form from the neighbouring scales. Under each of them lies a glandular body which terminates broad on a little pedicle turned towards the outer surface and splits into some blind *folliculi*. The presence and the mode of position of these *pori femorales* afford good generic characters; but their number is not constant in each species, and even differs in some

degree in one and the same individual on opposite sides. These parts appear to be more developed in males than in females. It has been doubted whether they are really glands, and whether the organ under the grooved tubercle ought not rather to be referred to *erectile* tissue[1].

Ophisaurus DAUD., CUV., FITZ., *Hyalinus* MERR. Teeth in jaws conical; palatine teeth small, numerous, in several rows. Auditory aperture small, transverse, behind the angle of mouth. Scales hard, osseous, the dorsal quadrangular, carinate, the ventral smooth, transverse, tetragonal. Extremities none. Lateral furrow on each side produced as far as vent. Body anguineous; tail longer than trunk.

Sp. *Ophisaurus ventralis* DAUD., *Anguis ventralis* L., DAUD. *Rept.* VII. Pl. 88. (v. Pl. 61, figs. 40, 41, the head), CUV. *R. Ani., éd. ill., Rept.* Pl. 24, fig. 1 (the cranium is figured in CUV. *R. Ani., éd.* I. Pl. IV, *éd.* II. Pl. VIII. figs. 7—9); this animal grows to 2′ in length, and is met with in North America; the tail is brittle, like that of the slow-worm, which peculiarity has occasioned the name of *glass snake*, given by the Anglo-Americans.

Pseudopus MERR. Palatine teeth small, in a single row. Scales all carinate, the carina more distinct in the caudal. Two rudiments of hind feet, adactylous, very small at the end of lateral furrow. (Remaining characters of *Ophisaurus*, from which it scarcely differs generically.)

Sp. *Pseudopus Pallasii* CUV., *Pseudopus serpentinus* MERR., *Lacerta apoda* PALLAS, *Nov. Comment. Acad. Petrop.* XIX. 1774, pp. 435—454, BECHST. *Naturgesch. d. Amphib.* II. Tab. 27, fig. 3, *Pseudopus Durvillii* (the young animal) GUÉRIN *Icon., Rept.* Pl. 17, fig. 1; the *scheltopusik;* this lizard, ranked by CUVIER amongst the serpents, attains a length of more than three feet. PALLAS first discovered this animal in Astrakan, where it occurs in the bushy valleys of the sandy steppes; it is met with also in Greece and Dalmatia.

Chamæsaura FITZ., WAGLER (Species of *Chamæsaura* SCHNEID.), *Monodactylus* MERR. Palatine teeth none. Body anguineous, covered all over with lanceolate scales, without lateral furrows. Four very short feet undivided, subulate. Tail very long.

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[1] Compare on these parts, besides J. MUELLER, who investigated them in *Polychrus marmoratus* (*De glandular. secern. structura*, p. 43. Tab. I. fig. 22), C. F. MEISNER *De Amphibiorum quorundam papillis glandulisque femoralibus*, Basiliæ 1832, 4to, and OTTH, *Ueber die Schenkelwarzen der Eidechsen*, in TIEDEM. u. TREVIRANUS *Zeitschr. für Physiol.* V. 1, 1833, pp. 101—104.

Sp. *Chamæsaura anguina* SCHNEID., *Lacerta anguina* L., VOSMAER, *Beschrijving van de zeldzame langstaartige, ruwgeschubde slanghagedis*, Amsterdam, 1774, LACEP. *Ann. du Mus.* II. Pl. 59, fig. 1, *Lézard monodactyle;* from the Cape of Good Hope.

Chalcides DAUD., CUV. (*Chalcis, Tetradactylus, Colobus* MERR.). Palatine teeth none. Four very short feet, with four toes or three, hinder sometimes adactylous. Lateral furrow behind fore feet.

Chalcides DUM., BIBR. Auditory aperture none. Lateral furrow evanescent at the middle of trunk.

Sp. *Chalcides cophias* MERR., LACEP. *Quadr. ovip. et Serp.* I. Pl. 32 (copied in BECHSTEIN *Naturgesch. d. Amph.* II. Tab. XV. fig. 2); S. America, &c.

Saurophis FITZ. Auditory aperture distinct. Lateral furrow extending as far as hind feet. Femoral pores. (Feet all tetradactylous.)

Sp. *Chalcides tetradactylus* DAUD., *Saurophis Lacepedii* DUM. and BIBR., LACEP. *Ann. du Mus.* II. Pl. 59, fig. 2, GUÉRIN *Iconogr., Rept.* Pl. 16, fig. 2; South Africa. This sub-genus is perhaps more nearly allied to *Gerrhosaurus* (p. 292) than to *Chalcides*.

Chirocolus WAGL., FITZ., *Heterodactylus* SPIX, DUM., BIBR. Palatine teeth none. Four short feet, posterior pentadactylous, anterior tetradactylous, with a clawless tubercle for a great toe (*pollex*). Auditory aperture none. Femoral pores. Sides of trunk not furrowed.

Sp. *Chirocolus imbricatus* WAGL., *Heterodactylus imbricatus* SPIX, *Spec. nov. Lacert. Bras.* Tab. 27, fig. 1.

Ecpleopus DUM. and BIBR.

Lepidosoma SPIX, WAGL. *Pentadactylus* DUM., BIBR.

On the genera, with palate edentulous, feet pentadactylous, lateral furrow none, comp. DUM. and BIBR. l. l. Tom. v. p. 428—488, and TSCHUDI *Die Familie der Ecpleopoda, Archiv f. Naturgesch.* 1847, s. 41—60, who adds the new genera, distinguished by smooth scales, *Euspondylus* and *Proctoporus*. All the species hitherto known, which are not numerous, are from South America.

Gerrhonotus WIEGM. Maxillary teeth cylindric, palatine very small, few, sometimes none. Four feet pentadactylous. Femoral pores none. Membrane of tympanum open, depressed. Longitudinal furrow on both sides. Scales of back hard, scutiform, mostly carinate. Tail long, verticillate, unarmed.

Sp. *Gerrhonotus rudicollis* WIEGMANN *Herpetol. mexic.* Tab. X. fig. 1;—*Gerrhonotus Deppii* WIEGM. l. l. Tab. IX. fig. 3; this last-named species has large dorsal scales not carinate. All the species are from America; the greatest number from Mexico.

Gerrhosaurus WIEGM. Maxillary teeth subulate, palatine conical, many. Four feet pentadactylous, with toes slender. Femoral pores. Membrane of tympanum open, depressed; anterior margin of auditory aperture furnished with a lunate scute. Longitudinal furrow on both sides, produced as far as hind feet. Tail long, verticillate, unarmed.

Sp. *Gerrhosaurus bifasciatus* DUM., BIBR. *Erpét.* Pl. 47;—*Gerrhosaurus lineatus* COCTEAU, GUÉRIN *Magas. de Zool.* 1833, *Rept.* Pl. 5, 6; these species are from Madagascar; some others are known from South Africa, as *Gerrhosaurus scpiformis*, which was referred by SCHNEIDER and MERREM to the genus *Scincus*.

Zonurus MERR., *Cordylus* GRONOV. Maxillary teeth subulate, equal, obtuse at the apex. Tongue oblong and triangular, emarginate at the apex, beset with filiform papillæ. Head triangular, flat above, declivous at the sides. Aperture of ears large, covered anteriorly by the exsert side of occiput. Four feet pentadactylous. Femoral pores in all, sometimes in a double row. Caudal scales carinate, with carina produced posteriorly into a strong spine. Longitudinal furrow on both sides. Abdominal scales quadrangular, flat, smooth.

Sp. *Zonurus griseus* DUM., BIBR., *Lacerta cordylus* L., SEBA *Thesaur.* I. Tab. 109, fig. 5 (tail monstrous, bifid); II. Tab. 62, fig. 3, *Zonurus cordylus* MERR. *Beitr.* III. Taf. VII. The scales of the back in this species form rings which correspond with those of the belly; on the other hand, they are much larger in *Zonurus cataphractus* GRAY (differing also in other characters), so that one row of dorsal scales corresponds to two rows of ventral scales.—*Zonurus microlepidotus* GRAY, *Cordylus microlepidotus* CUV., GUÉRIN *Iconogr., Rept.* Pl. 6, fig. 1, is distinguished by small tubercular dorsal scales. All these species are from South Africa.

Tribolonotus DUM., BIBR. Maxillary teeth equal, subulate. Tongue beset with scaly papillæ. Head flat above, declivous posteriorly; neck constricted, depressed. Membrane of tympanum naked, behind the angle of mouth. Osseous scutes, armed with a strong reclined spine, covering back and tail. Scales of abdomen transverse, imbricate. Sides of body rugose, without longitudinal

furrow, with small granulous scales. Four slender feet pentadactylous; femoral pores none.

Sp. *Tribolonotus novæ Guineæ* DUM., *Zonurus novæ Guineæ* SCHLEGEL, in V. DER HOEVEN *en* DE VRIESE, *Tijdschr. voor nat. Gesch.* I. 1834, Pl. VII. fig. 2, DUM. *et* BIBR. *Erpét.* V. Pl. 56. This animal, discovered by the traveller S. MUELLER on the west coast of New-Guinea, is justly separated from *Zonurus* as a distinct genus.

Family XVIII. *Lacertini.* Tongue exsertile, slender, bifid. Membrane of tympanum open, superficial or depressed. Body elongate, with four pentadactylous feet, the toes free, unequal. Ventral scales larger. Tail often very long. Femoral pores in many.

Tribe I. *Lacertæ.* Maxillary teeth with a hollow base, growing to the inner margin of jaws, anterior subulate, posterior obsoletely bicuspid or tricuspid, subcompressed. Head scutate. Ventral scales mostly quadrangular, arranged in transverse rows. Tail long, fusiform, sometimes rotundato-quadrangular at the base, elsewhere round. Tongue oblong and triangular, beset with scale-like papillæ, divided at the apex into two short, acuminate, smooth slips.

The true lizards, *Lacertæ*, are all from the old world, principally from Africa.

Ophiops (*Ophisops*) MÉNÉTRIES (*Amystes* WIEGM.). Eyes destitute of eyelids, furnished with an ocular capsule. Palatine teeth none. Collar none. Toes bicarinate below. Femoral pores.

Sp. *Ophiops elegans*, MÉNÉTRIES *Catalogue raisonné des objets de Zoologie recueillis dans un Voyage au Caucase.* St. Pétersbourg, 1832, 4to, p. 63; in Persia, Asia Minor and Syria. Compare WIEGMANN *Archiv f. Naturgesch.* 1835, s. 1—6, 1837, s. 123; see a fig. in DUM. *et* BIBR. *Erpét.* V. Pl. 53, fig. 1. BERTHOLD also gave a fig. of the head (*Ueber neue oder seltene Amphibienarten*, Göttingen, 1842, 4to, figs. 4, 5), and described a second species, *Ophiops macrodactylus*, pp. 14, 15.

Lacerta CUV., MERR. (Species from genus *Lacerta* L.). Eyelids distinct. Row of pores at the inside of thighs. Collar in most or a row of larger scales under the throat, to which succeeds a fold covered with minute scales, in front of the larger scales of abdomen.

Within the last few years many genera have been adopted here of which several contain only a single species. After careful

consideration I am only able, whilst regarding the general *habitus*, to notice these as sub-genera, which permit a more convenient view of the species hitherto known, about fifty in number.

Compare MILNE EDWARDS *Recherches Zool. pour servir à l'Hist. des Lézards, Ann. des Sc. natur.* XVI. 1829, p. 50—89.

a) *With toes carinate beneath or serrate at the margin.*

Psammodromus FITZ., *Notopholis* WAGL. Palatine teeth none. Collar none. Toes compressed, carinate beneath. Scales of back imbricate, carinate.

Sp. *Psammodromus hispanicus* FITZ., *Lacerta Edwardsiana* DUGÉS, *Ann. des Sc. nat.* XVI. p. 386, Pl. XIV.; Spain, South of France.

Add genus *Calosaura* DUM., BIBR. Sp. *Lacerta Leschenaultii* MILNE EDWARDS l. l. Pl. VI. fig. 9.

Eremias FITZ. Palatine teeth in some, in others none. Collar distinct. Toes compressed, carinate beneath. Scutella around the nostrils tumid.

Sp. *Lacerta variabilis* PALL.; Tartary. Most of the species are from South Africa.

Acanthodactylus FITZ. Palatine teeth none. Collar distinct. Toes compressed, carinate beneath, serro-fimbriate at the margins with sharp scales.

Sp. *Lacerta Boskiana* DAUD. *Rept.* III. Pl. 36, fig. 2, Egypt, &c.

Scapteria FITZ. Collar distinct. Toes depressed, smooth beneath, bordered on each side with somewhat long sharp scales.

Sp. *Lacerta grammica* LICHTENST., DUM. *et* BIBR. *Erpét.* V. Pl. 54, fig. 1, Africa.

b) *With toes subcompressed, smooth beneath, and not bordered at the sides.*

Lacerta DUM., BIBR. Collar distinct. Scales of abdomen larger, smooth, arranged in transverse parallel rows. A few teeth on each side at the posterior part of palate in most.

Sp. *Lacerta ocellata* DAUD. *Rept.* III. Pl. 33, *le Lézard vert*, LAC. *Quadr. ovip.* I. Pl. 20; this species, the largest of the genus, attains a length of full one foot, of which the tail forms the greatest half; it is found in Spain, Italy, and the South of France;—*Lacerta stirpium* DAUD., *Lacerta agilis* L. (in part), STURM *Fauna, Amphib.* Heft 2, DAUDIN *Rept.* III. Pl. 35, fig. 2, BELL *British Rept.* p. 18; *the Sand Lizard, hagedis, die gemeine*

Eidechse; this species becomes 6″ long; it feeds on insects and enjoys basking in the sunshine; the female lays from five to eight eggs, which are said to emit light for a time in the dark (GRUENDLER *Naturforscher* III. s. 128). Another still smaller European species is viviparous, or the young come to view immediately as the eggs are laid: *Lacerta vivipara* JACQ., *Zootoca crocea* WAGL., WIEGM., *Lacerta crocea* WOLF in STURM'S *Fauna, Amphib.* Heft 4, BELL l. l. p. 34, *Zootoca Guerini* COCTEAU in GUÉRIN *Magas. de Zool.* 1835, *Rept.* Pl. 9.

Tropidosaura BOIE (*Algyra* CUV.). Collar none. Abdomen covered with imbricate scales. Scales of back acuminate, acutely carinate.

Sp. *Lacerta algira* L., *Algyra barbarica* CUV., GUÉRIN *Iconogr., Rept.* Pl. v. fig. 2; from the North African coast, near Algiers;—*Tropidosaura montana* BOIE, found by KUHL and V. HASSELT in Java.

Tachydromus DAUD., MERR. Head acute. Scales carinate, quadrate, large in back and tail. Tail verticillate, very long. Two pores at the vent on each side.

Sp. *Tachydromus sexlineatus* DAUD. *Rept.* III. Pl. 39, *Tachydromus ocellatus* GUÉR. *Iconogr., Rept.* Pl. 5, fig. 3, in the East Indies, Java, Cochin China; I have not been able to find any teeth in the palate of this little animal.

Heloderma WIEGM. Snout obtuse, covered with four flat scuta. Head covered above with tuberculate scales. Teeth sharp, conical, grooved anteriorly; back covered with larger knotty scales; scutella of abdomen flat, smooth. Nostrils at the apex of snout. Third and fourth toe both of the fore and hind feet longer than the rest, subequal. Tail round, conical, almost equal to the trunk in length.

Sp. *Heloderma horridum* WIEGMANN, *Herpet. Mexican.* Tab. I. pp. 24, 25; TROSCHEL *Ueber Heloderma horridum, Archiv f. Naturgesch.* 1853, s. 294—315. Taf. 13, 14; Mexico.

Tribe II. *Ameivæ.* Maxillary teeth solid at the base, firmly fixed in a groove at the inner margin of jaws and growing to it, often directed obliquely outwards, the anterior mostly subulate, the posterior compressed or tuberculate. Palate edentulous in most. Often two transverse folds under the neck. Tongue beset with rhombic, imbricate scales, divided at the apex into two filaments.

This division contains species from the western hemisphere alone, where they represent the true lizards. Many of these

species are of a considerable size. With MERREM they form the genus *Tejus*.

Crocodilurus SPIX (add *Thorictis* WAGL. and *Neusticurus* DUM. and BIBR.). Tail compressed, with a double crest above, serrate, with scales erect. Palate edentulous. Pores femoral or inguinal. Head scutate.

Neusticurus DUM., BIBR. Back covered with lesser scales and with scutiform, carinate scales. Gular fold single, of larger scales. Row of pores continuous along the inner surface of whole thigh. Aperture of nostrils small in the middle of scute.

Sp. *Crocodilurus bicarinatus* nob., *Lacerta bicarinata* L. (according to DUMÉRIL), *Dracæna bicarinata* GUÉRIN *Iconogr., Rept.* Pl. 3, fig. 2, DUM. *et* BIBR. *Erpét.* v. Pl. 49; from South America, probably Guyana.

Thorictis WAGL., *Dracæna* DAUD., *Ada* GRAY. Back covered with large, scutiform, carinate scales, with smaller scales interspersed. Subgular fold double. Pores inguinal. Aperture of nostrils orbicular, placed in the suture of two scuta. Posterior teeth hemispherical, subflat.

Sp. *Crocodilurus Dracæna* nob., *Thorictis Dracæna* DUM. BIBR., *la Dragonne* LAC., *Quadr. ovip.* I. Pl. 16, DAUD. II. Pl. 28; CUV. *R. Ani., éd. ill., Rept.* Pl. 10 bis, fig. 2; this animal becomes more than 2′ 5″ long, and lives in South America in marshy regions; not only the tail, but the entire covering of the body, resembles, to a certain extent, that of the crocodiles.

Crocodilurus SPIX. Back covered with small scales obtusely carinate, oblong. Gular fold double. Femoral pores small.

Sp. *Crocodilurus amazonicus* SPIX (and *ocellatus* ejusd.), *Spec. nov. Lac. Brasil.* Tab. 20, 21; Brasil, Guyana.

Tejus MERR. (in part). Tail conical. Head scutate. Row of pores in inner part of thighs.

Centropyx SPIX., *Trachygaster* WAGL. Abdominal scales imbricate, carinate, with keel produced posteriorly into a sharp point.

Sp. *Centropyx calcaratus* SPIX, WIEGM., GUÉR. *Icon., Rept.* Pl. 4, fig. 3; Brasil, Surinam.

Tejus nob. Scales of abdomen quadrangular, smooth.

Sp. *Tejus Ameiva* MAXIM. *Abb. zur Naturgesch. Bras.*, Lief. V, SPIX *Nov. Spec. Lacert.* Tab. 23, GUÉRIN *Iconogr., Rept.* Pl. 4, fig. 1; distributed

over nearly the whole of South America, very common in Brasil; this species becomes 1½ feet long, moves very rapidly, and keeps principally in sandy regions.

Tejus monitor MERR., *Lacerta teguixin* L., MAXIM. *Abb.* Lief. XI., CUV. *R. Ani., éd. ill., Rept.* Pl. 11, fig. 1; this species also is not uncommon in Surinam and in a large part of Brasil; it attains a length of three or four feet; the tail is longer than the trunk; the back is black, with yellow spots; the belly yellow, with interrupted black transverse stripes. This animal, which is hunted in Brasil, and which is eaten, lives on insects, worms, frogs, resides in holes under ground, and hides also in hollow trunks of trees.

Note.—Here belong sub-genera *Salvator* DUM. and BIBR. (*Podinema* and *Ctenodon* WAGL.), *Ameiva* CUV., DUM. and BIBR., *Cnemidophorus* WAGL., and *Dicrodon* DUM. and BIBR.

Acrantus WAGL. (*Tejus viridis* MERR.) differs from all the others in having the hind feet tetradactylous.

Callopistes GRAVENHORST, FITZ., *Aporomera* DUM. and BIBR. Tail conical, obtusely quadrangular. Head covered with small scutella. Femoral pores none.

Sp. *Aporomera flavipunctata* DUM. *Erpét.* v. Pl. 51;—*Aporomera ornata* DUM., *Ameiva cœlestis* D'ORBIGNY.

Tribe III. *Monitores.* Tongue exsertile, elongate, narrow, sheathed at the base, with two long, filiform, acuminate apices. Head scaly, narrow, flat above. Palatine teeth none, maxillary teeth adnate, large, triangular or conical, distant. Neck long, not more slender than head. Femoral pores none. Feet pentadactylous with nails curved, compressed.

Varanus MERR., *Monitor* CUV. Snout elongate, covered with scales. Scales in back oval or oblong, gibbous, the larger surrounded by a scaly areola. Tail subtrigonal, rounded beneath, of the length of trunk or longer than trunk.

The species of this genus, all from the old world, are, after the crocodiles, the largest of lacertine animals; some attain a length of more than six feet. The tail in most of the species is compressed laterally and keeled above.

a) *Tail subrotundate or compressed only towards the apex, not carinate* (*Psammosaurus* FITZ., WAGL.).

Sp. *Varanus arenarius* DUM. and BIBR., *Varanus scincus* MERR., *Descr. de l'Egypte, Rept.* Pl. 3, fig. 2, in Egypt; the *land-crocodile* with HERODOTUS, *ouaran* of the Arabians, according to FORSKÅL.

b) *Tail compressed, carinate above* (*Polydœdalus* WAGL., *Hydrosaurus* ejusd.)

Sp. *Varanus niloticus* DUM. and BIBR., *Lacerta nilotica* L., *Tupinambis ornatus* DAUD., *Ann. du Mus.* II. Pl. 48; CUV. *R. Ani., éd. ill., Rept.* Pl. 10 bis, fig. 1; not in the Nile alone, but in different other rivers of West and South Africa;—*Varanus Bengalensis* DUM. and BIBR., *Monitor gemmatus* GUÉRIN *Iconogr., Rept.* Pl. 3, fig. 1;—*Varanus bivittatus, Tupinambis bivittatus* KUHL, SCHLEGEL *Abb.* Tab. 21, *Dict. univ. d'Hist. nat., Rept.* Pl. 4, fig. 2; this species, very common in Java and the rest of the Sunda Isles, grows to nearly 8′ in length, lives amongst bushes, in low situations; it swims and dives very well.

The species of the division of *Monitor* resemble the order of the serpents, not only in their tongue but also in the long narrow under-jaw, only loosely united in the middle. The covering of scales reminds us of that of *Acrochordus* and of *Hydrophis*.

Family XIX. *Iguanoidei.* Tongue fleshy, thick, not protractile, with apex alone free, entire or emarginate at the apex. Eyelids distinct, free. Teeth in some connected with the inner margin of jaws, in others fixed upon the free edge (*culmen*) of jaws. Head mostly covered with scales or small scutella, more rarely scutate. Back or tail often crested. Four feet pentadactylous (posterior very rarely tetradactylous), with toes free, unequal.

This family, very numerous in species, is especially remarkable from the great diversity of forms, which has occasioned the establishment of a number of genera. Only a single species, which is also common to North-Africa and Asia Minor, occurs in the South-east of Europe; all the rest are from other quarters of the world, many from Asia, but by far the most from South America. In the American species the teeth are attached to the inside of the jaws (*pleurodontes* WAGL., *prosphyodontes* WIEGM.); in those of the Eastern hemisphere they are (with a single exception) placed on the edge of the jaws and soldered there (*acrodontes* WAGL., *emphyodontes* WIEGM.). For this observation, more precisely confirmed by WIEGMANN and WAGLER, the science is indebted to the meritorious zoologist KAUP. From this different attachment of the teeth this family may be divided, as has been done by DUMÉRIL and BIBRON, into two groups, on better grounds than from the presence or the absence of teeth in the palate, as was done by CUVIER. The division, however, into ground-iguanas or agamas with flat head and flat depressed body, and tree-iguanas with compressed body, as proposed by WIEGMANN, appears to be more natural. Consequently

in each of these two groups two subdivisions may be adopted from the mode of attachment of the teeth.

Phalanx I. *Agamæ s. Humivagæ* WIEGM. (*Platycornæ* WAGL.). Body depressed. Head short, depressed, broad posteriorly. Membrane of tympanum mostly depressed, concealed more or less under spines or amongst folds of skin, rarely covered entirely by skin.

A. *With teeth soldered to the margin of jaws.*

Agama DAUD. in part, *Trapelus* KAUP, (*Trapelus* CUV. and species genus *Agama* CUV., *Phrynopsis*, *Podorrhoa*, *Trapelus* and *Eremioplanis* FITZ.). Head covered by numerous small scutella, often muricate with spines around the tympanum. Nostrils subtubular, approximate at the extremity of snout. Palatine teeth none. Incisor teeth subulate, canines larger, conical, oblique, molar small, compressed, triangular, obtuse. Submental fold longitudinal, neck-fold transverse. Femoral pores none, anal pores distinct. Tail of different length, mostly longer than trunk, covered with imbricate scales.

Sp. *Agama colonorum* DAUD., *Lacerta agama* L. (excl. synon. of SEBA) SEBA, *Thesaur.* I. Tab. 93, Tab. 107, fig. 3 (not 1 and 2); this species, one of the largest of the genus, has a long compressed tail, with large, keeled, pointed scales; it occurs on the coast of Guinea;—*Agama mutabilis*, *Trapelus ægypticus* CUV., DAUD. *Rept.* Pl. 43, fig. 1 (under the name of *Agama orbicularis*), *Agama pallida* REUSS, *Mus. Senckenb.* I. Tab. 3, fig. 3; this species has very small scales, with round tubercles scattered on the back; common in Egypt and Arabia; the tail is shorter than in the preceding species and conical. This lizard changes its colour like the chameleon.

Amphibolurus WAGL., WIEGM., *Gemmatophora* KAUP, *Grammatophora* DUM. (Characters and habits nearly of *Agama*, but there are small femoral pores. Head flat, triangular; nostrils near eyes. Amongst the dorsal scales, which are equal and imbricate, often some few that are spinose or tuberculate are intermixed).

Sp. *Amphibolurus muricatus* WIEGM., *Lacerta muricata* WHITE, *Journal of a voyage to New S. Wales*, Pl. 31, fig. 2, p. 244, *Agama Jacksoniensis* GUÉR. *Iconogr., Rept.* Pl. 7, fig. 1, from New Holland, like the rest of the species of this sub-genus.

Moloch GRAY, in G. GREY'S *Journals of two Expeditions in Australia*, London, 1841, 8vo. II., *Appendix*, pp. 440, 441, Pl. 2.

Sp. *Moloch horridus;* New Holland. Comp. DUMÉRIL, *Catalogue de la Collection des Rept.* Paris, 1851, pp. 109, 110.

Stellio DAUD. Head covered with numerous small scutella, spinose, short. Canine teeth distinct; palatine teeth none. Nostrils lateral, under a crest running from the eye to the snout. Back covered with small scales and some larger, tuberculate, scattered, furnished with a longitudinal fold on each side between the legs. Femoral pores none, anal distinct. Tail verticillate with large keeled scales.

Sp. *Stellio vulgaris* DAUD., *Lacerta stellio* L., *Agama cordylca* MERR., TOURNEFORT *Voyage du Levant,* Lyon, 1717, I. p. 373, RÜPPELL *Atlas zu der Reise in nördl. Afrika, Rept.* Tab. 2, GUÉRIN *Iconogr., Rept.* Pl. 6, fig. 2 (the head); found in Egypt, Asia Minor and Greece; in the sixteenth century (according to BELON, *Observations de plusieurs singularités,* pp. 114, 131) the excrement of this animal was used as a paint for the face, under the name of *Stercus Lacerti* or *Crocodilea.* In the same way the ancients made use of the excrement of the *land-crocodile,* or *Varanus scincus*; see above, p. 297 [1].

Uromastix MERR. Head obtuse, covered with numerous very small scutella. Canine teeth not distinct; superior incisors concrete in adults; apex of lower jaw edentulous. Back covered with very small, smooth scales. Femoral pores. Tail depressed at the base, broad, covered above with large, aculeate, verticillate scales.

Sp. *Uromastix spinipes* MERR., GEOFFR. *Rept. d'Egypte,* Pl. 2, fig. 2; CUV. *R. Ani., éd. ill., Rept.* Pl. 13, fig. 2.—*Urom. Hardwickii* GRAY, *Uromastix reticulatus* GUÉR. *Iconogr., Rept.* Pl. 6, fig. 4, &c. The tail of this animal has some conformity with that of *Zonurus.*

Leiolepis CUV. Head and back covered with very small, granular scales; scales of abdomen smooth, transverse. Tail very long, thick at the base, suddenly becoming slender, and running into a filiform extremity. Row of pores along the whole inner side of thigh.

Sp. *Leiolepis guttatus* CUV., GUÉRIN *Iconogr., Rept.* Pl. 7, fig. 2. Sumatra (and Cochin-China?).

Phrynocephalus KAUP. Head short, obtuse, almost circular. Membrane of tympanum concealed. Nostrils in the margin of

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1 *colorque*
Stercore fucatus crocodili.
HORAT., *Epodon,* XII. 10, 11.

snout. Body broad, flat. Scales small, ventral scales smooth. Gular fold. Anal and femoral pores none. Toes serrate. Tail slender.

Sp. *Phrynocephalus helioscopus* WAGL., *Lacerta helioscopa* PALL., GM., GRAVENHORST *Nov. Act. Acad. Leop. Carol.* XVI. p. 2, T. 64, figs. 9—14, p. 934, in the south of Siberia;—*Phrynocephalus auritus* KAUP, *Lacerta aurita* PALL. *Voyages dans plusieurs Provinces de Russie*, Tom. V. Pl. 9, fig. 1, DUM. *et* BIBR. *Erpét.* IV. Pl. 42, fig. 1, &c.

B. *With teeth united to the inner side of jaws.*

Phrynosoma WIEGM. Head covered with tuberculate scuta, armed posteriorly with large spines. Palatine teeth none. Body flat, aculeate. Gular fold. Tail short, broad at the base, suddenly gracilescent. Feet short. Femoral pores.

Sp. *Phrynosoma orbiculare* WIEGM., *Lacerta orbicularis* L. (in part, excl. synon. of SEBA referrible to *Agama spinosa*), GRAVENHORST l. l. Tab. 68, pp. 911—917, WIEGM. *Herpet. Mexic.* Tab. 8, fig. 1; in Mexico and also in the United States. Here also belong *Phrynosoma cornutum*, *Agama cornuta* HARLAN, and two other species, all figured in HOLBROOK *North Americ. Herpet.* III. Pl. 9—12.

Sceloporus WIEGM., *Tropidolepis* CUV., DUM. and BIBR. Head scutate. Palatine teeth none. Large imbricate scales, dorsal keeled, abdominal smooth. Large femoral pores.

Sp. *Sceloporus undulatus*, *Agama undulata* DAUD., HOLBROOK *N. Americ. Herpet.* III. Pl. 8, North America, Mexico, West Indies;—*Sceloporus torquatus* WIEGMANN, *Herp. Mex.* Tab. 7, fig. 1; from Mexico like various other species, on which compare WIEGMANN lib. cit.

Tropidurus NEUW., WIEGM. (*Proctotretus* DUM. and BIBR., *Ecphymotes* CUV., DUM. and BIBR., not FITZ., *Hoplurus* CUV., DUM. and BIBR.). Head scutate, short, triangular, not distinct from trunk. Nostrils tubular. Palatine teeth distinct. Scales imbricate, mostly large, the upper carinate, acuminate, the subjugular and abdominal smooth. Femoral pores none.

Liolæmus WIEGM., *Proctotretus* DUM., BIBR. Throat not folded. No crest at nape. Some præanal pores in males.

Sp. *Tropidurus chilensis* WIEGM. &c. Comp. WIEGMANN *Nov. Act. Acad. Leop. Carol.* Tom. XVII. p. 1. There is a certain conformity of habit with the Scincs.

Tropidurus FITZ., *Ephymotes* CUV. Throat folded transversely. Anal pores none. Nape not crested.

Sp. *Tropidurus torquatus* MAXIM., *Abb. zur Naturgesch. Bras.* Lief. VI.; in Brasil, on rocks, old walls; runs quickly and climbs with great facility.

Hoplurus CUV., FITZ. Throat folded transversely. Anal pores none. Nape subcristate.

Sp. *Tropidurus Cuvieri* GRAY, WIEGM., *Uromastix cyclurus* MERR., SEBA *Thesaur.* I. Tab. 97, fig. 4, GUÉR. *Icon., Rept.* Pl. 12, fig. 3; this species is the true *Quetz-paleo* of SEBA, which name has been given erroneously to various other species of *Saurii.*

Strobilurus WIEGMANN, *Steironotus* FITZ., in part.

Steirolepis FITZ., *Platynotus* WAGL., *Microlophus* DUM. and BIBR.

Platycercus AUG. DUM. Head covered with polygonal scales, scabrous. Palatine teeth. Fold at the sides of throat. Two or three femoral pores on each side, scarcely conspicuous. Tail short, thick, flat below, armed with aculeate spines above.

Sp. *Platycercus aculeatus* AUG. DUMÉRIL, *Revue et Magas. de Zool.* 1854, Pl. 12; habitat in Brasil.

Urocentron KAUP, *Doryphorus* CUV. Palatine teeth none. Deep jugular fold. Scales of back small, not imbricate, smooth, gibbous. Femoral pores none. Tail verticillate with large keeled scales.

Sp. *Urocentrum azureum* WAGL., *Lacerta azurea* L., SEBA *Thes.* II. Tab. 62, fig. 6, *Stellio brevicaudatus* DAUD. *Rept.* IV. Pl. 47; GUÉR. *Icon., Rept.* Pl. 6, fig. 3, &c.

Here also FITZINGER placed, under the name of *Doryphorus Maximiliani*, the species described by the PRINCE of NEUWIED as the *Quetz-Paleo* of SEBA, *Nov. Act. Acad. Leop. Car.* XIV. Tab. 15 (*Oplurus Maximiliani* DUM. and BIBR.).

(On some other sub-genera comp. FITZINGER *Syst. Rept.* 1843, pp. 70—79).

Phalanx II. *Iguanæ* s. *Dendrobatæ.* Body compressed, with back keeled, often crested. Head tetragono-pyramidal. Membrane of tympanum mostly naked, superficial.

A. *With teeth united to the inner side of jaws.*

Anolius CUV., (*Anolis* DAUD., DUM.), *Dactyloa* WAGL. Head flat above, declivous at the sides, covered with numerous scutella, often tuberculate. Palatine teeth. Aperture of auditory meatus

small; membrane of tympanum rather depressed. Scales all small. Femoral pores none. Toes very unequal, with last phalanx expanded and finely striated beneath with transverse folds. Skin under the throat mostly expanded into a sac. Tail long.

Dracontura FITZ., *Draconura* WAGL. Toes scarcely expanded. Middle dorsal scales larger than lateral. Tail somewhat round, very long.

Sp. *Anolius refulgens* SCHL.;—*Dracontura 12 lineata* BERTH., *Dracontura Bertholdi* FITZ., BERTHOLD *Ueber einige neue oder wenig bekannte Amphibienarten*, 1842, Tab. II. fig. 7.

Dactyloa WAGL. Toes furnished with an obovate expansion.

a) *With abdominal scales flat, often imbricate.*

Sp. *Anolius punctatus* DAUD., *Rept.* IV. Pl. 48, fig. 2, *Anolis viridis* MAXIM., *Abb. zur Naturgesch. Bras., Rept.* 7;—*Anolius lineatus* GRAVENH., DUM., *Lacerta strumosa* L., DAUD. *Rept.* IV. Pl. 48, fig. 1;—*Anolius Cepedii* MERR., *Anolius alligator* DUM., BIBR., *le Roquet* LAC. *Quadr. ovip.* I. Pl. 27. These are small species, often with lively colours. In many the tail has an erect crest, which, in *Anolius velifer* CUV., *R. Ani.* Pl. V. fig. 1, is supported by the spinous processes of the caudal vertebræ.

b) *With abdominal scales granular, very small.*

Pseudochamæleon FITZ., *Chamæleolis* COCTEAU. Sp. *Anolis chamæleonides* DUM., BIBR.

Læmanctus WIEGM., FITZ., *Ecphymotes* FITZ.

Sp. *Læmanctus acutirostris* WIEGM., DUM. and BIBR., *Polychrus acutirostris* SPIX, *Lacert.* Tab. XV. *a;* no femoral pores; palate without teeth; the toes without dilatation.

Note.—FITZINGER places here as sub-genera the genera *Norops* WAGL., and *Urostrophus* DUM. and BIBR.

Polychrus CUV., MERR. Head depressed above, covered with flat unequal scutella, the middle and anterior larger. Anterior maxillary teeth subulate, posterior compressed, obsoletely tricuspidate. Palatine teeth short, conical. Scales small, mostly carinate, imbricate. Throat folded, dilatable like a sac. Row of small femoral pores. Tail very long.

Sp. *Polychrus marmoratus* CUV., *Lacerta marmorata* L., SEBA *Thesaur.* II. Tab. 76, fig. 4, tongue fancied, LAC. *Quadr. ovip. et serp.* I. Pl. 26, GUÉRIN *Iconogr., Rept.* Pl. 11, fig. 3, &c.; Brasil, Surinam. These and some other lacertine animals of the same family possess the property of changing colour, like *Chamæleon* and *Calotes* of the eastern hemisphere.

Callisaurus BLAINV., DUM. and BIBR., *Megadactylus* FITZ. Head scutellate, short. Palatine teeth none. Scales small, smooth, imbricate. Throat folded longitudinally, expansile; jugular fold transverse. Row of femoral pores. Toes slender, elongate. Tail shorter than trunk, depressed beneath.

Sp. *Callisaurus draconoides* BLAINV., *Nouv. Ann. du Muséum*, IV. 1835, Pl. 24, fig. 2. North America, California.

Cophosaurus TROSCH.

A genus much resembling the preceding, but distinct from it and the other congeners in having the membrane of tympanum covered, and in the defect therefore of auditory pore. Sp. *Cophosaurus texanus* TROSCHEL, *Archiv f. Naturgesch.* 1850, s. 388, Taf. VI.

Hypsibatus WAGL., WIEGM.

Ophryoëssa BOIE. Head short, covered with subequal scutella. Anterior teeth subulate, posterior compressed, triangular, tricuspidate. Palatine teeth distinct. Throat folded longitudinally, not expansile into a sac; jugular fold transverse. Femoral pores none. Scales small, keeled, imbricate. Crest running above the back and the very long, compressed tail.

Sp. *Ophryoëssa superciliosa* BOIE, *Lacerta superciliosa* L., SEBA *Thesaur.* I. Tab. 96, fig. 6, II. Tab. 14, fig. 4, *Lophurus xiphosurus* SPIX, *Lacert.* Tab. 10, GUÉRIN *Iconogr., Rept.* Pl. 8, fig. 1; Brasil, Surinam.

Cyclura HARLAN (*Ctenosaura* WIEGM. previously). Head covered with scutella. Anterior teeth conical, posterior tricuspid, compressed. Palatine teeth distinct. Skin of throat lax, folded transversely, not inflatable. Jugular fold transverse. Membrane of tympanum superficial. Serrated, low crest, formed of erect triangular scales along the middle of back and tail. Scales very small; tail very long with scales larger, aculeate, verticillate.

Sp. *Cyclura pectinata* WIEGM., *Herpet. Mexic.* Tab. 2;—*Cyclura denticulata* WIEGM. l. l. Tab. 3, *Cyclura acanthura* BLAINV. *Nouv. Ann. du Mus.* IV. Pl. 24, fig. 1, &c.

Brachylophus CUV. Head covered with scutella very small, flat, numerous, subequal. Skin of throat lax, pendulous. Palatine teeth. Scales of back granulous, small, scales of feet, belly and tail carinate. Tail very long. Femoral pores. Low pectinate crest along the middle of back and base of tail.

Sp. *Brachylophus fasciatus* CUV., *Iguana fasciata* BRONGN., *Essai classific. Rept.* p. 34, Pl. 1, fig. 5, GUÉRIN *Iconogr., Rept.* Pl. 9, fig. 1; New Guinea, East Indies. This species is the only one hitherto found in the eastern hemisphere which belongs to the division of the *Pleurodontes*.

Iguana DAUD., CUV., (in part), *Hypsilophus* WAGL. Head covered with scutella and scuta in the middle part. Nostrils tubular. Membrane of tympanum superficial. Palatine teeth distinct, in a double row on each side. Anterior maxillary teeth subulate, posterior oval, compressed, with margin denticulate. Throat with dewlap pendulous, compressed, denticulate. Crest in middle of back and tail formed of erect acuminate scales. Row of large femoral pores. Abdominal scales larger, dorsal very small.

Sp. *Iguana tuberculata* LAUR., *Lacerta Iguana* L., SEBA *Thesaur.* I. Tab. 95, fig. 1, Tab. 97, fig. 3, HOUTTUYN *Natuurl. Hist.* I. 6e Stuk, Pl. 52, fig. 2, DAUD. *Rept.* III. Pl. 40; CUV. *R. Ani., éd. ill., Rept.* Pl. 17; in South America, scarcely further than to 14° S. L.; in Brasil it is called *senembi*; the taste of its flesh and of its eggs is esteemed;—*Iguana nudicollis* CUV., *Iguana delicatissima* LAUR. (excl. synon.), SEBA *Thesaur.* Tab. 96, fig. 5, GUÉRIN *Iconogr., Rept.* Pl. 11, fig. 1; West Indies, Brasil.

Note.—Add sub-genera: *Amblyrhynchus* BELL, *Aloponotus* DUM., BIBR., and *Metopoceros* WAGL. In *Amblyrhynchus* the dewlap is absent, in the others it resembles that of *Iguana*; these last are distinguished from the *Iguanæ* by a double row of femoral pores, and by flat subvertical nostrils.

Corythophanes BOIE (and *Chamæleopsis* WIEGM.). Head short, covered with small scutella, flat or concave above, crested above the eyes, produced posteriorly into a kind of helmet. Membrane of tympanum superficial. Palatine teeth distinct. Back crested. Throat furnished with dewlap. Jugular fold. Femoral pores none. Scales of feet, tail and abdomen keeled. Tail very long, growing slender, not crested. ...

Sp. *Corythophanes cristatus, Agama cristata* DAUD., SEBA *Thesaur.* I. Tab. 94, fig. 4; this species has a membranous crest in the neck, on which the row of erect scales, which is continued along the back, begins; the scales of the back are small, smooth, irregular; the throat-sac is dentated below.—*Corythophanes chamæleopsis* DUM., BIBR., *Chamæleopsis Hernandesii* WIEGM., *Herpet. Mexic.* Tab. 6. In this species the membranous crest in the neck is absent and the row of erect scales begins above the back; on the back some keeled scales stand in three or four inconspicuous transverse bands. Both species are from Mexico.

Basiliscus LAUR., CUV. (species from genus *Basiliscus* DAUD., MERR., add *Corythæolus* KAUP). Head crested posteriorly by an erect cutaneous fold, covered with small scutella. Palatine teeth distinct. Back and tail to the very end keeled with a row of erect scales. Throat lax, rugose; neck folded transversely. Scales of back keeled, disposed in transverse rows. Femoral pores none. Toes of hind feet denticulate.

Sp. *Basiliscus mitratus* DAUD., *Lacerta Basiliscus* L., SEBA *Thes.* I. Tab. 100, fig. 4 (fig. copied in HOUTTUYN *Natuurl. Hist.* I. 6, Tab. 52, fig. 1), DAUD. *Rept.* III. Pl. 42, GUÉR. *Iconogr., Rept.* Pl. 11, fig. 2; Surinam, West Indies. In some adult species (probably male) the membranous crest on the back and tail is very high and is supported by the spinous processes of the vertebræ.

B. *With teeth set upon the margin of jaws and concrete with jaws. (Palatine teeth none.)*

† *With femoral pores distinct.*

Histiurus CUV. (and *Physignathus* ejusd.), *Lophura* GRAY. Membrane of tympanum superficial. Back crested. Toes of hind feet surrounded by a membrane or denticulate. Scales of back carinate, less than those of abdomen. Tail long, compressed.

Sp. *Histiurus amboinensis* CUV., *Lacerta amboinensis* SCHLOSSER, *Epistola ad* F. DEJEAN, Amstelodami, 1768, 4to, CUV. *R. Ani., éd. ill., Rept.* Pl. 15, fig. 1; a large species from Celebes, Amboyna, &c. In full-grown male specimens the spinous processes of the anterior caudal vertebræ are much elongated, and support a high crest which rests on the fore part of the tail like a dorsal fin;—*Histiurus physignathus* DUM., BIBR., *Physignathus cocincinus* CUV. *R. Ani., sec. éd.* Pl. 6, fig. 1, GUÉRIN *Iconogr., Rept.* Pl. 9, fig. 2.

Chlamydosaurus GRAY. Head scaly. Membrane of tympanum superficial. Back not crested. Scales lanceolate, keeled. A folded, scaly, ample membrane covering the neck like a cloak, affixed above tympanum on each side. Toes simple. Tail very long, round.

Sp. *Chlamydosaurus Kingii* GRAY, GRIFFITH'S *Animal Kingdom*, IX. Plate opposite to p. 217, DUM. *et* BIBR. *Erpétol.* Pl. 45; New Holland; this species attains a considerable size, like the *Histiurus* of Amboyna and the *Iguanas* of America.

†† *With femoral pores none.*

a) *With hind feet tetradactylous.*

Semiophorus WAGL., FITZ., *Sitana* CUV., DUM. and BIBR. Scales rhombic, keeled. Membrane of tympanum superficial. Throat of males with a very large dewlap, pendulous, folded; of females, with the skin tense. Tail slender, very long.

Sp. *Semiophorus pondicerianus* WAGL., *Sitana pondiceriana* CUV., *R. Ani., sec. édit.* Pl. 6, fig. 2, GUÉRIN *Iconogr., Rept.* Pl. 10, fig. 2.

b) *With all the feet pentadactylous.*

* *With sides of trunk expanded.*

Draco L. Canine teeth large, subulate; molar triangular, with margin trilobed. A duplicature of skin on each side of the body, supported by the anterior false ribs, which are elongate, straight. Throat furnished with a middle pendulous dewlap, long in males, and two others lateral, small. Tail long, slender; small imbricate scales.

Flying lizard or *dragon.* This genus contains small lizards from the Indian Archipelago, of which also a single species occurs on the continent of the East Indies. They live in trees and feed on insects.

Compare on the anatomy F. TIEDEMANN *Anatomie und Natur-geschichte des Drachens.* Mit 3 Kupfert., Nürnburg, 1811, 4to; on the species of this genus, besides DUMÉRIL and BIBRON, SCHLEGEL *Abbild. neuer Amphibien,* pp. 81—96, Tab. 24, may be consulted.

Sp. *Draco viridis* DAUD. (and *Draco fuscus* ejusd.), *Draco volans* L. (and *Dr. præpos* L.), DAUD. *Rept.* III. Pl. 41, TIEDEMANN l. l. Tab. 1, SCHLEGEL l. l. fig. 1;—*Draco fimbriatus* KUHL, GUÉR. *Iconogr., Rept.* Pl. 10, fig. 1; both from Java and Sumatra; the last is the largest of known species. In some the tympanic membrane is concealed under the scaly skin, as in *Draco lineatus* DAUD., *Draco volans* BLUMENB., *Abb. Naturh. Gegenst.* No. 98, SCHLEG. l. l. fig. 5. From these species WIEGMANN forms the genus *Dracunculus.* I have not observed in a single specimen that the fore limbs are attached to the parachute, as is stated by SEBA in the description of a figure in his work (I. Tab. 102, fig. 2). On this character *Draco præpos* L. rests.

** *With sides of trunk not expanded.*

a) *Membrane of tympanum conspicuous.*

Calotes CUV. Head scaly. Back crested. Throat lax, pendulous like a sac. Tail very long, gracilescent.

Calotes DUM. and BIBR. Scales of back equal, arranged in oblique rows. Jugulum not folded.

Sp. *Calotes ophiomachus* MERR., *Lacerta calotes* L., SEBA *Thes.* I. Tab. 93, fig. 2, Tab. 95, figs. 3, 4, LAC. *Quadr. ovip. et Serp.* I. Pl. 19, DAUD. III.

Pl. 43; light blue, with white transverse bands; the scales large and thin; those of the belly keeled and pointed; Bengal;—*Calotes gutturosus* WIEGM., *Bronchocela cristatella* KAUP, *Agama moluccana* LESS., DUPERREY *Voyage autour du Monde, Rept.* Pl. 1, fig. 1; GUÉR. *Iconogr., Rept.* Tab. 7, fig. 3; a very common species in the Sunda-islands.

Gonyocephalus KAUP, *Lophyrus* DUM. Scales of back small, arranged in transverse rows, with larger and rounded interposed. Jugular fold transverse, angulate. Tail compressed or subcompressed.

Sp. *Calotes megapogon* Mus. L. B., *Lophyrus dilophus* DUM. and BIBR. *Erpét.* Pl. 46, New Guinea;—*Calotes tigrinus* nob., *Gonyocephalus tigrinus* GRAY, SEBA *Thes.* 1. Tab. 100, fig. 2, SCHLEG. *Abbild.* Tab. 23, DUM., BIBR. *Erpét.* Pl. 41; Java, Sumatra; with a short head, flat or concave above, strongly declining forwards; a sharply projecting edge above the eyes.

Arpephorus A. DUMÉR.

Sp. *Arpephorus tricinctus* A. DUMÉRIL, GUÉRIN *Magasin de Zool.* 1851, Pl. 7; this animal, which is known to me from the figure referred to alone, would seem to be a native of Java: in addition to the dorsal scales placed in transverse rows and the compressed tail of *Gonyocephalus*, it has a flattened projection of skin, like a sword, that terminates in a point at the fore part of the head[1].

β) Membrane of tympanum concealed.

Ceratophora GRAY.

Otocryptis WIEGM.

Lyriocephalus MERR., DUM. and BIBR. (*Lyrocephalus* WAGL.). Head crested on both sides above the eyes, the crest at the occiput running out into a point. Globose tubercle at the point of snout. Throat with dewlap obsolete; jugular fold angulate. Back and tail with a low, denticulate crest. Tail compressed. Scales at the sides of back granular, small, with larger subrotund and keeled interposed. Abdominal scales larger than dorsal, keeled.

Sp. *Lyriocephalus margaritaceus* MERR., *Lacerta scutata* L., SEBA *Thesaur.* 1. Tab. 109, fig. 3, CUV. *R. Ani., éd. ill., Rept.* Pl. 15, fig. 2; Ceylon.

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[1] In the Museum at Leyden there is a specimen with the provisional name of *Calotes nasicornis*, that in colour and in position of the scales corresponds with the figure of *Arpephorus*, but has only a small pointed and soft appendage on the snout. The scales also, which are very large and almost quadrangular, are conspicuously keeled, of which DUMÉRIL gives no notice. I cannot perceive an external tympanic membrane.

Family XX. *Chamæleonidei* (*Chamæleontes* WIEGM.). Teeth of jaws united to the margin; palatine teeth none. Tongue protractile to a great distance, fleshy, round, thick at the apex, glutinous. Scales small, granular. Feet four, slender, pentadactylous, with toes divided into two opposite fasciculi. Membrane of tympanum concealed under skin.

Chamæleon GRONOV., MERR., FITZ., WAGL., *Chamæleo* LAUR., DUM., BIBR. Characters those of the family. (Teeth compressed, anterior very small, posterior larger, tricuspidate. Occiput produced into a kind of helmet. Outer toes of fore feet two, of hind feet three. Femoral pores none. Two horizontal eyelids concrete to form a single circular eyelid, furnished with a small aperture in front of the large eye. Back compressed, keeled. Tail prehensile, long.)

The genus *Chamæleon* is clearly distinguished from all the other *Saurii*, however *Lyriocephalus* in some degree resembles it. Most of the species belong to Africa, and especially to the island of Madagascar; the common North-African species occurs also in Spain, and was known to the ancients, who in regard to the changes of colour of this animal, advanced the erroneous opinion that its colour changes to that of the objects on which it is placed. Chameleons are not more remarkable for this change of colour than for the motion of their tongue as swift as an arrow[1]. By this the sluggish animals capture the insects on which they feed; with the mouth itself or with the feet they never seize their prey.

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[1] According to HOUSTON, when this takes place there occurs at the same time a swelling from congestion of the blood-vessels, a true erection. *Essay on the structure and mechanism of the tongue of the Chamæleon, Transact. of the Roy. Irish. Acad.* Dublin, 1828; this opinion was, however, afterwards contested by RUSCONI (MUELLER'S *Archiv*, 1844, s. 508—519). It is simply a muscular action; the hyoïd bone is produced into a slender tapering style which penetrates the tongue and is surrounded by a lax and mucous sheath. The *m. m. geniohyoïdeus* and *mylohyoïdeus* move this style forwards upon the horns of the hyoïd bone, whilst, in the substance of the tongue itself, there are also curved and decussating muscular fibres which radiate from the circumference to the center and press upon the organ in such a way as to cause it to glide along the lingual style of the hyoïd bone. These fibres form what BRUECKE calls the *m. accelerator linguæ*. See his remarks on the tongue of the Chameleon in *Sitzungsberichte der math. naturw. Classe der Kaiserl. Acad. der Wissensch.* VIII. 1852, s. 65 and foll. Similar independent observations were published at the same time by J. ZAGLAS in J. GOODSIR'S *Annals of Anat. and Physiol.* Edinb. 1852, no. II., pp. 138—153, Pl. VI. See also a careful dissection and explanation of the movements of the tongue of the Chameleon by SALTER in TODD'S *Cyclop. of Anat. and Physiol.* IV. pp. 1147—1150.

Compare on the internal structure of this genus W. VROLIK. *Natuur-en ontleedkundige Opmerkingen over den Chameleon.* Met. Pl. Amsterdam, 1827, 8vo. See, also, AUG. DUMÉRIL *Famille des Caméléoniens, Archives du Mus. d'Hist. nat.* VI. 1852, pp. 257—264, Pl. 21, 22.

Sp. *Chamæleon vulgaris* CUV., *Lacerta chamæleon* L. (excl. of some citations), *Chamæleon carinatus* MERR., GUÉRIN *Iconogr., Rept.* Pl. 15, fig. 1; figured in its different colours in my *Icones ad illustrandas coloris mutationes in Chamæleonte,* L. B. 1831, 4to; see also E. BRUECKE *Untersuchungen über den Farbenwechsel des africanischen Chamæleons, Denkschr. der math. naturw. Classe der Kaiserl. Akad.* IVter Bd. Wien, 1852;—*Chamæleon bifidus* BRONGN., *Essai classif. nat. des Rept.* Pl. II. fig. 7, DAUD. *Rept.* IV. Pl. 54, East Indies, Mauritius, Madagascar (and New Holland?); remarkable from the two processes projecting in front of the head, formed by the frontal and upper jaw-bones; see CUV. *Rech. sur les ossem. foss.* V. 2, Pl. 16, figs. 30, 32. Another species from Western Africa, near the Equator, which I know only from the description, differs by a crest on the back, which, as in *Basiliscus* and *Histiurus,* is supported by the spinous processes of the vertebræ: *Chamæleon cristatus* STUTCHBURY, *Trans. Linn. Soc.* XVII. Tab. 10, p. 361.

Family XXI. *Ascalobotæ.* Body depressed, covered with small imbricate scales and often with scattered tubercles; scales of back smaller, of abdomen and feet a little larger. Head depressed, large, with marginal scutes at each jaw, elsewhere entirely scaly. Tongue short, fleshy, papillose, with apex free, obtuse, scarcely emarginate. Aperture of auditory passage distinct; membrane of tympanum depressed. Palatine teeth none, maxillary thin, subulate, numerous, adhering to the internal margin of jaws. Eyes large, covered by an immoveable eye-lid as though by a transparent capsule; pupil often oblong, vertical. Tail moderate. Feet short, pentadactylous, the anterior sometimes with thumb very short, the rest of fingers subequal. (Femoral pores in some distinct, in most none.)

The *Geckoïd Lizards* have many remarkable characters by which they are distinguished from the other families of this order, and, like the Chameleons, form an independent group. The eyes, as J. MUELLER pointed out, are, as in the serpents, covered by a transparent eye-lid, behind which the eye has a free motion. These animals have mostly a leaf-like expansion at the toes which is folded below, and the nails (which, however, in some species are wanting on some of the toes or even altogether) are capable of retraction, as in cats.

These animals feed on insects. The name *Gecko* is derived from the sound which they make, and which in one or more Indian

species resembles this word. Species of this family are found in the warm regions of both hemispheres of the earth; many live in houses, and climb with ease the walls and ceilings. Most of the species are small, 5″—7″, few only attain a length of 10″.

On this family may be compared the Monograph (now somewhat antiquated) of J. G. SCHNEIDER, *Denkschriften der Königl. Akad. der Wissenschaften zu München für die Jahre* 1811 *und* 1812, s. 31—70, Tab. 1.

Lomatodactylus mihi. Toes dilated, striated beneath.

Platydactylus CUV. (and *Thecadactylus* ejusd.), DUM. and BIBR. Toes dilated or winged through their whole length, finely plicated transversely beneath. Tail mostly covered with small scales both above and below.

A) *With feet cloven.*

a) *With all the toes unarmed; the back with small sub-equal scales.* Sp. *Platydactylus ocellatus* CUV. (and *inunguis* ejusd.), CUV. *R. Ani.* Pl. 5, figs. 3, 4; Cape of Good Hope; a small species, known to the colonists there by the name of *geitje*; WIEGMANN formed from this species his genus *Pachydactylus*;—*Platydactylus cepedianus* CUV. l. l. fig. 5, at Madagascar and the island Mauritius; in this species the thumb of the fore foot is only a short stump; *femoral pores* are present, which are wanting in the first-named species.

b) *With thumb and second and third fingers unarmed.* (*Femoral and præanal pores none. Tubercles carinate or gibbous, scattered amongst the scales of back.*) Sp. *Platydactylus mauritanicus, Lacerta mauritanica* L., *Gecko fascicularis* DAUD., BONAP. *Faun. Ital., Amfibi*, Tav. 54, fig. 1; ash-coloured, with transverse bands of tubercles on the back; this species is met with in the south of France, Italy, Spain and Algiers; useful in houses from destroying insects, it is however avoided and persecuted as venomous, an example of human ingratitude.

c) *With thumb alone unarmed, the other fingers unguiculate.* (*Femoral or præanal pores at least in males.*) Sp. *Platydactylus guttatus* CUV., *Lacerta Gecko* L., SEBA *Thesaur.* I. Tab. 108, figs. 1—9, DAUD. *Rept.* IV. Tab. 49; one of the largest species of this genus, very common in the East Indies, in the Sunda-islands, and also in China;—*Platydactylus vittatus, Gecko vittatus* HOUTTUYN, *Verhandel. van het Zeeuwsch Genoostschap*, IX. 1782, bl. 336, fig. 2, BRONGNIART *Classif. nat. des Rept.* fig. 6, CUV. *R. Ani., éd. ill., Rept.* Pl. 20, fig. 1; Amboyna, Timor; brown red, with a milk-white stripe along the middle of the back, which divides into two branches at the head, running towards each eye; the tail with white rings. In this species *pori femorales* are present only in males; they lie in a curved line, almost from the middle of the abdominal surface in front of the *cloaca* to the end of the thighs at the knee-joint.

d) *With all the fingers unguiculate.*

Sp. *Platydactylus seychellensis* DUM. and BIBR.

Note.—To this division belongs sub-genus *Thecadactylus* Cuv., with toes sulcate below, the groove receiving a nail. Femoral pores none.

Sp. *Platydactylus theconyx* Dum. and Bibr., *Gecko rapicauda* Houtt. *Verh. van het Zeeuwsch Genootschap*, l. l. fig. 1 (tail monstrous from regeneration), *Gecko lævis* Daud. *Rept.* iv. Pl. 51, *Stellio perfoliatus* Schneid. *Denkschr. der Akad. zu München*, l. l. Tab. i. figs. 1, 2; in Surinam; the only species of this sub-genus.

B) *With feet palmate.*

a) *With thumb unarmed, rest of fingers unguiculate. Ptychozoon* Kuhl., *Pteropleura* Gray.

Sp. *Platydactylus homalocephalus* Cuv., *Lacerta homalocephala* Creveld, *Magazin der Gesellsch. naturf. Freunde zu Berl.* iii. 1809, Tab. 8, Dum. *et* Bibr. *Erpét.* Pl. 29; a flat scaly expansion along the sides is thrown round like a cloak upon the belly; the tail is as if finned with round flat lobes on each side; in the male *pori præanales* are present. This remarkable species occurs in Java and Sumatra.

b) *With fingers all unguiculate.*

Sp. *Platydactylus Leachianus* Cuv. Sub-genus *Rhacodactylus* Fitz.

Hemidactylus Cuv. Toes winged at the base, with first phalanx expanded into an oval disc striated beneath, second phalanx and third round, slender. Tail covered below with a middle row of transverse scutes.

Sp. *Hemidactylus Mabouia* Cuv., *Gecko incanescens* and *G. armatus* Maxim. *Pr. zu* Wied; South America;—*Hemidactylus verruculatus* Cuv., *Hemidact. triedrus*, Bonap. (not Daud.) *Faun. Ital. Amfibi*, Tav. 54, fig. 2; South of Europe and Northern Africa.

There is a species of this genus with half swimming-membranes at the feet and a flat tail spinous at the sides. *Hemidactylus marginatus* Cuv., *Stellio platyurus* Schn. l. l. fig. 3, Dum. *et* Bibr. *Erpét.* Pl. 30, fig. 2, from Java. Here also would seem to be the place for the species known only from a figure of Seba (*Thesaur.* ii. Tab. 103, fig. 2), from which Wagler forms the genus *Crossarchus*.

Ptyodactylus Cuv. Toes slender, dilated towards the points, with a disc below folded like a fan, emarginate. Toes all unguiculate, the nail received in a groove below the disc. Femoral pores none.

Sp. *Ptyodactylus Hasselquisti* Dum., Bibr., *Lacerta Gecko* Hasselq. *Ptyodactylus guttatus* Rueppell, *Reise, Atlas, Rept.* Tab. iv. fig. 1; Egypt, Arabia; this species has a round tail. In other species the tail is flat and leaf-shaped, as *Ptyodactylus fimbriatus* Cuv., *Gecko fimbriatus* Daud., Merr., Lacep. *Quadr. ovip.* i. Pl. 30, Daud. *Rept.* iv. Pl. 52; the head is very flat; along the sides of the lower jaw, the neck and the whole of the trunk, runs

a thin and short border, which is irregularly incised; this species becomes still larger than *Platydactylus guttatus*, and attains a length of 10''; it occurs at Madagascar.

Sphæriodactylus CUV. Toes slender, dilated towards the extremity, with cushion not folded. Femoral pores none.

Phyllodactylus GRAY, WIEGM. Toes all unguiculate, furnished under the dilated extremity with two squamiform, smooth cushions. Sp. *Sphæriodactylus porphyreus* CUV., *Gecko porphyreus* DAUD., MERR.; from Southern Africa.

Diplodactylus GRAY, WIEGM. All the unguiculate toes supplied under the scarcely dilated extremity with two oval cushions, carnoso-papillose.

Sphæriodactylus GRAY, WIEGM. All the toes unarmed, dilated into an apical, subrotund cushion.

Sp. *Sphæriodactylus sputator* CUV., *Anolis sputator* DAUD., LAC. *Quadr. ovip.* I. Pl. 28. (A very small species, only 2'' long, with dark-brown transverse stripes on the back, from St Domingo.)

Stenodactylus FITZ., CUV., mihi, (add. *Gymnodactylus* SPIX, CUV., *Gonyodactylus* KUHL, *Phyllurus* CUV.). Toes simple, slender, all unguiculate.

Stenodactylus CUV., FITZ. Toes denticulate at the margin with sharp scales. Femoral pores none.

Sp. *Stenodactylus elegans* FITZ., *Stenodactylus guttatus* CUV., *Descr. de l'Egypte, Rept.* Pl. V. fig. 2.

Gymnodactylus SPIX, (add. *Phyllurus* CUV.). Toes with margin entire, often elongate, geniculate. Femoral pores mostly none.

Sp. *Stenodactylus scaber* RUEPPELL, *Atl. zu der Reise im nördl. Afr., Rept.* Tab. IV. fig. 2, &c.

There is a species with tail leaf-shaped, compressed, becoming narrow towards the extremity, and with long curved toes, which is found in New Holland: *Stenodactylus phyllurus, Phyllurus platurus* CUV., *Lacerta platura* WHITE, *Journ. of a Voyage to New South Wales*, Pl. 32, fig. 2, GUÉRIN *Iconogr., Rept.* Pl. 14, fig. 1, CUV. *R. Ani., éd. ill., Rept.* Pl. 20 *bis*, fig. 2; it is coloured greyish-black above and covered with many spinose tubercles.

TRIBE II. *Loricati.*

Maxillary teeth conical, received into sockets at their base. Slit of cloaca oblong. Penis single. Body covered above with large scutes tuberculate or carinate.

Family XXII. *Crocodilini.* Maxillary teeth conical, palatine none. Head covered with skin not scaly, adhering closely to the cranial bones. Tongue adherent on all sides, flat, fleshy. Trunk and tail mailed above and below with large, quadrangular scutes; lesser scales at the sides of trunk oval or rounded. Hind feet palmate or semipalmate. Tail compressed.

Crocodilus GRONOV., LAUR., SCHN. Characters of the family those of the single genus. (Feet with three inner toes alone unguiculate, anterior pentadactylous, posterior tetradactylous. Transverse cutaneous fold above the auditory meatus. Tail longer than trunk; a serrated crest extending above the tail, double at its base, confluent and single towards the extremity.)

The crocodiles are large lizards that live in fresh water, and are met with in warm regions of both hemispheres of the earth. They are very voracious predacious animals; by day they keep more on dry land, whilst they pass the night in the water, and then make quest for their prey. HERODOTUS and ARISTOTELES have noticed various interesting particulars concerning the crocodile of the Nile, which have been confirmed by the later accounts of travellers. For a long period different species of this genus have been known, which LINNÆUS united under the name of *Lacerta Crocodilus*, and which SCHNEIDER, and after him CUVIER more especially, have distinguished with critical accuracy; about twenty species are now known.

Compare J. G. SCHNEIDER *Hist. Amphib.* II. pp. 1—170; CUVIER *Sur les differentes espèces de crocodiles vivans et sur leurs caractères distinctifs, Ann. du Mus. d'Hist. nat.* X. 1807, pp. 8—66; also transferred and amplified in his *Recherch. s. l. Ossem. foss., sec. éd.* V. 2, pp. 14—66; F. TIEDEMANN, M. OPPEL and J. LIBOSCHITZ *Naturgeschichte der Amphibien, Erstes Heft, Krokodil.* Mit 15 Taf. Heidelberg, 1817, folio.

† *Upper jaw broad, obtuse, with margin extended beyond the teeth of lower jaw.*

Alligator CUV., *Champsa* WAGL.[1] Hind feet semi-palmate. Teeth

[1] This name ought to be suppressed; it applies rather to the crocodile of the Nile, which the Egyptians, according to HERODOTUS named thus, as at the present day, according to the unanimous relation of travellers, *temsach*. *Alligator* (a corruption of the Portuguese *lagarto*, which word is itself formed from *lacerta*) is the common name which English voyagers and colonists give to the American crocodiles, whilst other Europeans employ the name *Kaaiman* (Cayman or Caïman).

unequal; the point of the fourth tooth of the lower jaw on each side capable of reception in a pit of the upper jaw.

Sp. *Crocodilus sclerops* Cuv., *Ann. du Mus.* x. Pl. 1, fig. 76, 6, the skull, Pl. 11, fig. 3, the nuchal shields or scutes, Tiedemann, Oppel u. Libosch. l. l. Tab. 5, Maxim. *Abb. zur Naturgesch. Brasil.* Lief. xii.; *Caiman fissipes* Spix, *Champsa fissipes* Wagl., Fitzinger and J. Natterer, *Beiträge zur nähern Kenntniss der Sud-Amerikanischen Alligatoren, Annalen des Wiener Museums*, ii. 1839, p. 321, Tab. 22; this species is met with in South America, and attains a length of 8'. Other species also from South America were formerly confounded under the collective name of *Sclerops*. All the species of this sub-genus are from the western hemisphere; they occur in higher latitudes than the crocodiles of the eastern hemisphere. *Crocodilus lucius* Cuv., *Crocodilus missisipiensis*, Daud., Cuv. *Ann du Mus.* l. l. Pl. 1, figs. 8, 15, Pl. 2, fig. 4, Tiedem., Oppel u. Libosch. Tab. 4, with a flat head, round in front, which attains a length of 14'; lives in North America.

†† *Upper jaw not wider than lower. Fourth tooth of lower jaw on each side received on the emarginate outside of upper jaw. Hind feet palmate.*

Crocodilus Cuv. Teeth unequal. Head gradually narrowed towards the snout. Margins of upper jaw waved (festooned).

Of this sub-genus of the crocodiles proper most of the species are from the eastern hemisphere. From the western are *Crocodilus rhombifer* Cuv., Tiedem., Oppel u. Libosch. l. l. Tab. 10, from Mexico and Cuba, and *Crocodilus acutus* Geoffr. St.-Hil., *Ann. du Mus.* ii. Pl. 37, fig. 1, Cuv. *Ann. du Mus.* x. Pl. 1, figs. 3, 14, Pl. 2, fig. 5, Tiedem., Oppel u. Libosch. l. l. Tab. 13, from St Domingo.

Of the species of the old world we notice, in the first place, that earliest known from the Nile, *Crocodilus vulgaris* Cuv., *Ann. du Mus.* x. Pl. 1. figs. 5, 12, Pl. 2, fig. 7, Wagl. *natürl. System der Amphib.* Pl. 7, Tiedem. Oppel u. Libosch. Tab. 8; with six keeled plates on the upper part of the neck, four in the first and two in the hinder row; the large dorsal shields form transverse rows, each consisting of six shields. The nilotic crocodile is now no longer met with in the Delta, but only in Upper Egypt; in addition in many other parts of Africa, in the Senegal, &c.—In the East Indies at the Sunda-islands, &c. is found *Crocodilus biporcatus* Cuv., *Ann. du Mus.* x. Pl. 1, figs. 4, 13, 18, 19, Pl. ii. fig. 8, Tiedem., Oppel u. Libosch. l. l. Tab. 9, with two tuberculated projecting ridges running along the head from the eyes forward. This species attains a length of eighteen feet.—In the interior of Borneo the voyager S. Mueller discovered a remarkable species, with snout much elongated, which, accordingly, he thought might be regarded as a gavial, *Crocodilus Schlegelii, Tijdschr. voor natuurl. Gesch. en Physiol.* v. 1838, bl. 61—87, Pl. 3; this species is very beautifully figured in the *Verh. over de natuurl. Gesch. der Nederl. Overzeesche Bezittingen, Reptilia*, Tab. i. ii. (Gray has lately united this species incorrectly with *Crocodilus Journei*. Compare on this

last-named species the article *Crocodile* by BORY ST VINCENT, *Dict. class. d'Hist. natur.* v. p. 111, and the fig. Pl. 119, Liv. 14, No. 8.)

Gavialis OPP., *Rhamphostoma* WAGL. Teeth equal; upper jaw with margin straight. Head narrowed abruptly with a very long cylindrical snout.

Sp. *Crocodilus gangeticus, Lacerta gangetica* GMEL., LAC. *Quadr. ovip.* I. Pl. 15; the cranium figured *Ann. du Mus.* X. Pl. 1, figs. 2, 10, XII. Pl. 1, figs. 6, 7, the nuchal shields X. Pl. 2, fig. 11; the only species of this subgenus hitherto known. It lives in the Ganges, attains a remarkable size, and feeds principally on fish. The adult male has a large tubercle at the extremity of the upper jaw; compare hereon GEOFFR. SAINT-HILAIRE *Mém. du Mus.* 1825, pp. 100—115, Pl. 5.

ORDER VI. *Chelonii.*

Cavity of tympanum distinct; membrane of tympanum in most naked, in some covered. Eyes with three eyelids. Teeth none. Feet four. Body covered with a double shield, the upper composed of confluent ribs, the lower of the sternum.

Family XXIII. *Chelonii.* (Characters of the order those also of the single family.)

Tortoises.—They form with LINNÆUS only a single genus *Testudo*, with 15 species; at present more than 130 are known. On the composition of the shields we have already spoken shortly, (p. 207). The scapula and the bones of the pelvis are situated under the ribs and the spinal column; the muscles which move the limbs are covered by the shields. In the vertebral column the seven cervical vertebræ with the first dorsal vertebra, two or three sacral and the caudal vertebræ, are alone capable of free motion. Ten dorsal vertebræ, on the contrary, are immoveably connected with the angular, flat, bony pieces, which form the middle row of the dorsal shield. With these bony pieces the flattened expansions of the ribs are connected on each side by suture; finally, the dorsal shield is bordered by eleven bony pieces on each side. The dorsal shield, consisting of these pieces, is in some tortoises flatter, in others more round, and especially in the land-tortoises is much arched. As to the sternal shield, we have already stated above (p. 207) that it consists of nine pieces; these leave between them open spaces in the sea-tortoises (turtles), and in the three-nailed freshwater

tortoises (the genus *Trionyx*), which are occupied by fibro-cartilage; in the land-tortoises, on the other hand, and in the genus *Emys*, the nine pieces of the sternum are mutually united by suture in the adult period without interposed cartilage. The tortoises are tenacious of life, and exhibit a long persistence of irritability in parts that have been divided from the body. They attain a great age[1]. Most of them live on vegetable food, or on molluscs also. During the pairing season the tortoises, at other times usually timorous and dull, are uncommonly lively and courageous. When copulating, which is a work of days, the male is carried on the back of the female. The females lay their eggs on the land, although copulation, in the species that live in water, takes place there; they bury the eggs when laid in the ground, in open places exposed to the sun; those that live in water do this at such a distance from the shore of the sea, or from the bank of rivers, that the highest state of the water cannot reach them. The number of eggs is various; the land-tortoises lay the smallest number, four or five, some species however more, twelve or twenty; the fresh-water tortoises more; the sea-tortoises the greatest number; commonly a hundred, or even more.

Compare J. G. SCHNEIDER, *Allgemeine Naturgeschichte der Schildkröten*, Leipzig, 1783, 8vo;—J. D. SCHŒPFF *Historia testudinum iconibus illustrata*, Erlangæ, 1792, 4to; accurate figures and descriptions distinguish this work, which is unfinished (32 col. plates, 132 pp.);—T. BELL, *A Monograph of the Testudinata*, London, 4to (this work, commenced in 1826, contains very beautiful coloured figures; it is still incomplete. I have seen 34 plates of it);—L. FITZINGER *Entwurf einer systematischen Anordnung der Schildkröten, Ann. des Wiener Museums*, I. 1835, s. 103—128. (A. F. SCHWEIGGER *Prodromus Monographiæ Cheloniorum*, Regiomonti, 1814, is known to me only from quotations.) A. DUMÉRIL *Description des Reptiles du Muséum. Chéloniens. Archives du Mus. d'Hist. nat.* VI. 1852, pp. 212—249.

The work of BOJANUS already noticed (p. 211) is the chief work for the anatomy.

A. *Toes distinct. Feet palmate.*

Trionyx GEOFFR. (*Gymnopus* and *Cryptopus* DUM. and BIBR.). Covering of beak horny. Lips distinct, soft. Nose proboscidian.

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[1] Two examples are adduced of tortoises that continued alive more than a century in a garden in England; J. G. SCHNEIDER *Sammlung vermischter Abhandlungen*. Berlin, 1784, s. 308, 309.

Neck very long. Shell depressed, covered with smooth skin. Feet with only three internal toes unguiculate. Tail short.

The absence of horny plates on the flat shield distinguishes this genus not less than the three-nailed swimming feet. All the species live in fresh water and are carnivorous. Sp. *Trionyx Ægyptiacus* GEOFFR., *Testudo triunguis* FORSK., GMEL., GEOFFR. ST.-HIL., *Ann. du Mus.* XIV. Pl. 1, 2, *Dict. des Sc. nat., Erpétol.* Pl. 3; this species lives in the Nile and eats the young crocodiles with avidity as soon as they have escaped from the egg. See the skeleton described and figured in C. A. MOHRING *Diss. inaug. zootom., sistens descriptionem Trionychos Ægyptiaci osteologicam*, Berolini, 1824, 4to;—*Trionyx ferox* SCHWEIGG., *Testudo ferox* PENNANT, LAC. *Quadr. ovip.* I. Pl. 7, *Trionyx spiniferus*, LESUEUR *Mém. du Mus.* XV. p. 258, Pl. 6; this species, which attains a very large size, lives in North America, in the rivers Wabash, Tennesee, and Ohio. Most of the species of this not very numerous genus are from the East Indies.

Chelys DUMÉR., WAGL., *Matamata* MERR. Covering of beak thin, nearly cutaneous. Nose proboscidian. Head depressed, trigonal. Dorsal shell depressed, small, covered with horny scutes; supracaudal (pygal OWEN) marginal scutella two. Anterior feet with five nails, posterior four. Neck fimbriato-carunculate, not retractile, capable of flexion towards the sides of thorax.

Sp. *Chelys fimbriata* SCHWEIGG., *Testudo fimbriata* SCHN., GMEL., SCHŒPFF *Hist. Testud.* Tab. 21 (figure re-engraved from that given by BRUGUIÈRE, *Journ. d'Hist. natur.* 1792), DAUD. *Rept.* II. Pl. 20, fig. 1, SPIX *Spec. nov. Test. et Ran.* Tab. 11; CUV. *R. Ani., éd. ill., Rept.* Pl. 7, fig. 2; the only known species of this genus which approaches nearer to *Emys* than to *Trionyx;* this animal lives in stagnant fresh water in Guyana and Brasil.

Emys BRONGN. (DUM.). Covering of mandibles horny. Anterior feet mostly with five nails, posterior with four. Dorsal shield sub-gibbous, covered with horny scutes; supracaudal marginal scutella two.

This genus is the most numerous in species of the entire order of tortoises; most of them are met with in America. *Emys* is a Greek name of tortoises that reside in fresh water. PLINIUS, *Hist. nat.* Lib. 32, cap. 4.

† *Neck capable of flexure to the sides of shield. Pelvis conjoined with sternum.*

Hydraspis BELL, FITZ. (*Platemys* WAGL., DUM. and BIBR., with addition of some other genera of modern writers).

Sp. *Emys Planiceps* SCHW., *Testudo planiceps* SCHN., SCHŒPFF l. l. Tab. 27; —*Emys Maximiliani* MIKAN, *Hydromedusa Maximiliani* WAGL. *Syst.*

Amphib. Tab. 3, figs. 25, 26; compare PETERS in MUELLER'S *Archiv.* 1839, Tab. XIV. figs. 1—4, figure of the skull. This species and most others of this sub-genus are met with in South America. Some others are from Africa, and some from New Holland, as *Emys longicollis, Chelodina longicollis* GRAY, DUM. and BIBR. *Erpét.* II. Pl. 21, fig. 2.

(*Note.*—Sub-genera *Pentonyx* DUM. and BIBR., and *Sternotherus* BELL, are distinguished by five nails of hind feet.)

†† *Neck retractile under the shell between the fore feet. Pelvis not conjoined with sternum.*

Chelydra SCHW., WAGL., *Emysaurus* DUM. and BIBR. Sternum small, narrow at the middle part, cruciform, immoveable. Anterior feet with five nails, posterior with four. Tail elongate, crested.

Sp. *Emys serpentina* MERR., *Testudo serpentina* L., SCHŒPFF l. l. Tab. 6, DUM. *et* BIBR. *Erpét.* Pl. 17, fig. 1; North America, in lakes and rivers; the dorsal shield with three keels, excised behind, and with three points on each side.

Staurotypus WAGL.

Sp. *Emys odorata* SCHWEIGG., *Testudo odorata* DAUD. Tab. 24, fig. 3, SCHŒPFF, Tab. 24, fig. B.

Cinosternum SPIX, WAGL. Anterior part of sternum moveable, with middle part immoveable, posterior obscurely moveable.

Sp. *Emys scorpioides* (and *Emys Retzii*) SCHW., *Testudo scorpioides* L.

Cistuda FLEMING, *Emys* WAGL. (*Terrapene* MERR. in part). Sternum divided by transverse suture into two moveable parts, capable of being drawn towards the dorsal shell when the animal is retracted.

Sp. *Emys carolina* (*Testudo carolina* L.?), *Testudo clausa* GMEL., SCHŒPFF l. l. Tab. 7, CUV. *R. Ani., éd. ill., Rept.* Pl. 4, fig. 2, North America, Cumberland River, Tennessee; BLOCH has described this tortoise under the name of *Dosen-Schildkröte, Schriften der Gesellsch. naturf. Freunde zu Berlin,* VII. p. 131;—*Emys Europæa* SCHW., *Testudo orbicularis* L., *Testudo lutaria* SCHN., GMEL., LAC. *Quadr. ovip.* I. Pl. 4, 6, SCHŒPFF l. l. Tab. 1. BOJANUS l. l. Tab. 1.; dorsal shield black, with interrupted light yellow stripes; this species occurs in the south and east of Europe; the shell is capable of closing like a box less perfectly than in the preceding species.

Emys DUM. and BIBR., *Clemmys* WAGL. Sternum immoveable, broad.

Sp. *Emys picta* SCHW., SCHŒPFF l. l. Tab. 4, CUV. *R. Ani., éd. ill, Rept.* Pl. 4, fig. 1; from North America, as are most of the species of this sub-genus.

Many species also are known from the East Indies; one of the most interesting is *Emys spinosa* BELL l. l. Tab. v. with a spine on the middle of each of the dorsal plates and spines at the margin. From the small development of the swimming-membrane of the feet this species approaches in some degree to the land-tortoises.

Note.—To this sub-genus are to be referred sub-genera *Tetraonyx* LESS., with only four nails on both anterior and posterior feet (LESSON *Illustr. de Zool.* Pl. 7), and *Platysternon* GRAY.

B. *Toes indistinct.* (*Covering of beak horny.*)

Testudo BRONGN., *Chersine* MERR. Feet truncated, with short nails. Back gibbous. (Nails of fore feet five, seldom four, of hind feet four. Posterior marginal scute or supracaudal almost always single, broad).

Sp. *Testudo Græca* L., SCHŒPFF l. l. Tab. 8, 9, BONAP. *Faun. Ital., Amfibi,* Tab. 48; the shield oval, somewhat broader behind than in front; this species has commonly (but not always) two marginal shields above the tail; it occurs in Spain, Italy, and Greece. Most of the species are from Africa; as the very common, prettily marked *Testudo geometrica* L., SCHŒPFF l. l. Tab. 10, DAUD. *Rept.* II. Pl. 23, fig. 1, from the Cape of Good Hope; a species almost entirely similar in marking, but somewhat more elongate, without an unpaired scutellum at the fore margin, which is deeply incised, has been found in the East Indies, *Testudo actinodes* BELL, *la Geométrique* LAC. *Quadr. ovip.* I. Pl. 9.—There lives in South America the *Testudo tabulata* WALBAUM, SCHŒPFF l. l. Tab. 13, MAXIM. *Pr. v.* NEUW. *Abb. z. Naturgesch. Bras., Rept.* Tab. 3, very common in collections.

Testudo areolata THUNB., SCHŒPFF l. l. Tab. 23, from the Cape of Good Hope, has only four nails on the fore feet. This species belongs to a small group, to which DUMÉRIL has given the name of *Homopus.*

In some the posterior part of the dorsal shield is moveable downwards, *Testudo Homeana, Cinixys Homeana* BELL; in a single species the anterior part of the sternal shield is moveable, *Testudo pyxis, Pyxis arachnoïdes* BELL. See TH. BELL, *On two new genera of Land Tortoises, Linn. Transact.* XV. 1827, p. 392—401, Tab. 16, 17.

Chelonia BRONGN. Feet changed into flat fins, anterior very long, falcate. Back depressed. Sternum imperfect, in part cartilaginous. (Nails only two or one; more rarely none.)

Chelonia BRONGN., DUM., *Caretta* MERR. Back covered with horny scales.

Sp. *Chelonia mydas* SCHW., *Testudo mydas* L., *Caretta esculenta* MERR., LAC. *Quadr. ovip.* I. Pl. 1; in the Atlantic Ocean, in the Indian and other seas,

in regions far remote, eatable, the shell is not made use of.—*Chelonia imbricata* SCHW., *Testudo imbricata* L., LAC. *Quadr. ovip.* I. Pl. 2, SCHŒPFF l. l. Tab. 18, CUV. *R. Ani., éd. ill., Rept.* Pl. 6, fig. 2; with smooth horny scales on the dorsal shield covering each other like house-tiles, of a yellow colour with black dashes; this species occurs in various seas of warm regions, especially in the East Indies, and affords the best tortoise-shell. The ancients were used to inlay boxes and even couches with tortoise-shell, of which CARVILIUS POLLIO set the example.

Dermatochelys LESUEUR, *Sphargis* MERR., DUM., and BIBR. Back covered with leathery skin, in younger individuals warty. Nails none.

Sp. *Chelonia coriacea, Testudo coriacea* L., LAC. *Quadr. ovip.* I. Pl. 3, SCHLEGEL *Faun. Japon., Rept.* Tab. I.; CUV. *R. Ani., éd. ill., Rept.* Pl. 7, fig. 1 (younger specimen); this species attains a length of 6—8′; it lives in various seas, occurring now and then in the North Sea, on the coasts of England and France[1].

The form of the anterior fin in the turtles nearly resembles that of the wings in the genus of the *Penguins* (*Aptenodytes*).

[Extinct genera of reptiles occur in the secondary and tertiary formations. Some of these are of peculiar interest as forming connecting links not only between remote families of reptiles, but also between the class of reptiles and the other classes of vertebrate animals.

Besides CUVIER *Ossements fossiles*, v. 2, we refer especially to OWEN *Report on British Fossil Reptiles, Report of the Brit. Association* for 1839, pp. 43—126, *ibid.* for 1841, pp. 60—204, also (published by the Palæontographical Society, London) OWEN *On the Fossil Reptilia of the London Clay*, Pt. I. *Chelonia*, 1849, *ibid.* Pt. II. *Crocodilia* and *Ophidia*, 1850, *ibid. On the Fossil Reptilia of the Cretaceous Formations*, 1851, *ibid. Fossil Chelonian Reptiles of the Wealden Clays and Purbeck Limestone*, 1853, *ibid. Fossil Reptilia of the Wealden Formations*, Pt. III. *Megalosaurus Bucklandii*, 1856.

Saurobatrachi.

Cryptobranchus primigenius VAN DER HOEV. See p. 242. From the tertiary freshwater lime formation at Œningen.

Labyrinthodon OWEN, *Mastodonsaurus* JÆGER. General character of skull batrachian, with affinities to the crocodilian structure

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[1] Here probably is to be referred the account of a large turtle on the coast of Zealand; JOS. VAN IPEREN *Verhandelingen van het Zeeuwsch Genootschap*, VI. blz. 620.

in face and jaws. Nostrils subterminal, with posterior apertures of air-passages distinct. Single row of small teeth in upper jaw, with two or three larger tusks at the anterior extremity, and a continuation of small teeth external and anterior to the tusks. Palatine (vomerine) teeth in a transverse row, and a longitudinal row on each side of the outer margin. Single row of teeth in lower jaw with a large tusk on each side of the symphysis.

The teeth are slender in proportion to their length, not very acute, striated towards the base; for their structure see OWEN *Odontogr.* pp. 202—205, Pl. 64 A, figs. 2, 3, 64 B, fig. 1, fig. 2. They are anchylosed in shallow sockets, as in certain fishes. New Red sandstone of Warwick and Leamington, and lower part of the Triassic series (*Keuper*) in Germany. OWEN renders it probable that the foot-prints referred to the so-named *Cheirotherium* were made by *Labyrinthodon*. *Brit. Assoc. Report*, 1841, p. 188. Some of the species attained a length of several feet.

Archegosaurus GOLDFUSS. Teeth similar in structure to those of *Labyrinthodon*, but the foldings less complex. Body covered with small scales.

Sp. *Archegosaurus Dechenii;* cranium six and a half inches long, breadth half the length; and other species; GOLDFUSS *Beiträge zur Fauna der Steinkohlengebirges*, Bonn, 1847, 4to.

Parabatrachus OWEN. Sp. *Parabatrachus Colei;* from the Coal Shale, Glasgow; OWEN *Journ. of Geol. Soc.* IX. 1853, pp. 66—70.

Brachyops OWEN.

Brachyops laticeps; sandstone of the lower Jurassic period; *Journ. Geol. Soc.* I. 1845, pp. 318—322.

Telerpeton MANTELL.

Sp. *Telerpeton elginense:* this is perhaps the most ancient reptile known. The fragments were discovered in the Devonian rocks of Morayshire; *Quarterly Journ. Geol. Soc.* 1852, VIII. p. 100. It is referred to the salamanders, but with lacertine characters.

Serpentes.

Palæophis OWEN. Allied to *Python* and *Boa*.

Sp. *Palæophis toliapicus*. London clay at Sheppey (Eocene tertiary). *Brit. Assoc.* 1841, p. 180, &c.

For other genera see OWEN *Palæontogr. Soc.* 1850, pp. 57—68.

Enaliosauria OWEN.

Nostrils near the summit of head. Vertebræ biconcave or nearly flat. Ilium not connected to sacral ribs by synchondrosis, but

simply lying upon them. Coracoïd and pubic bones much expanded. Fore and hind extremities with numerous phalangeal bones forming paddles.

Plesiosaurus CONYB. Head small, neck of great length (20—40 vertebræ); tail short. Vertebræ either flat or slightly concave.

Pliosaurus OWEN. Head very large; teeth in distinct sockets with subtrihedral crown. Neck short, with very short vertebræ. Vertebræ in back longer. The articular surfaces of the vertebræ are flat in the cervical, slightly concave in the dorsal, rather more concave in the caudal.

> OWEN states that, as a rule, the length of the vertebræ is constant in *Enaliosaurs*, in crocodiles and in lizards, whatever other modifications they may undergo. The cervical region both in *Pterodactyles* and in *Pliosaurus* forms a remarkable exception; in the first case the vertebræ being much longer, in the other much shorter, than the dorsal vertebræ. Though the teeth are in separate sockets yet the septa are much lower than the outer and inner walls. *Report of Br. Assoc.* 1841, pp. 60—65.

Ichthyosaurus KŒNIG. Neck short. Head as broad as thorax. Orbits very large; eye with numerous sclerotic plates. Teeth not lodged in distinct sockets, but both the outer and inner plates of alveolar groove are present. Vertebræ deeply biconcave. Tail relatively much longer than in the preceding genus. Probably a caudal crest.

> On the *Enaliosaurs* see OWEN *Rep. of Br. Assoc.* for 1839, pp. 43—126. Many species of *Plesiosaurus* and *Ichthyosaurus*, the former about twice as numerous as the latter, have been found in the secondary strata from the Lias and lower Oolite to the Chalk, when they finally perished in the latter deposit.

Pterosauria OWEN.

Pterodactylus CUV., *Ornithocephalus* SŒMMER. Teeth conical, recurved, in separate sockets with wide interspaces. Cervical vertebræ longer than the rest. Pectoral extremity modified for flying, the fourth very long, clawless finger appearing to have sustained a membrane. Lithographic limestone (Upper Oolitic system) and the chalk.

> These animals were very various in size: some species from the chalk were gigantic; the distance between the tips of the wings in *Ptcr. Cuvieri* is estimated by OWEN at not less than eighteen feet. OWEN *Palæont. Soc.* 1851, p. 104.

Saurii.

Thecodontosaurus RILEY and STUTCHBURY. Differs from the existing lizards in the dentition, being neither according to the *acrodont* form (anchylosed to the summit of alveolar ridge), nor the *pleurodont* (anchylosed to the outer wall of alveolar groove), but implanted in sockets either loosely or confluent with the bony wall of the cavity. Teeth conical, rather slender, compressed, acute, anterior and posterior edges finely serrated. Pulp cavity remains open in base of crown. Lacertine form of pectoral and probably of pelvic arch combined with crocodilian characters of vertebræ and ribs. Vertebræ biconcave.

Sp. *Thecodontosaurus antiquus* RIL. and STUTCH. Oldest division of the New Red sandstone.

Palæosaurus RIL. and STUTCH. Same locality. Teeth comparatively much broader than in the preceding.

Rhynchosaurus OWEN. Cranial structure lacertine, jaws with chelonian and ornithic modifications. Vertebræ biconcave. New Red sandstone. OWEN *Rep. Br. Assoc.* 1841, pp. 145—153. *Trans. of the Cambridge Phil. Soc.* 1842, Tom. VII. Pt. 3, p. 335, Pl. 5, 6.

In the three last genera, from the oldest division of the New Red sandstone, containing the most ancient of lacertine animals, the spinal canal is moniliform, sinking into the middle part of the centrum of the vertebræ.

Dicynodon OWEN. Jaws like the last but with mammalian canine teeth. Vertebræ slightly biconcave. From sandstone rock at the south-eastern extremity of Africa. *Journal of the Geol. Soc.* I. 1845, pp. 318—322.

Cladyodon OWEN. Teeth compressed, anterior and posterior edges serrate; in their breadth, as compared with their length, they are intermediate between *Thecodontosaurus* and *Palæosaurus platyodon*, thus approaching the form of *Megalosaurus*.

Sp. *Cladyodon Lloydii* OWEN. Teeth alone known. Same locality as *Thecodontosaurus*.

Protorosaurus MEYER. Thecodont type of dentition, long and thin. Feet resemble those of the Monitors.

Sp. *Protorosaurus Speneri*, from the cupriferous schist of Thuringia; CUV. *Ossem. foss.* V. 2, pp. 300—306.

Mosasaurus CONYB. Acrodont type of dentition. Teeth smooth; palatine (pterygoïd) teeth. Vertebræ concavo-convex. Locomotive extremities unknown.

Sp. *Mosasaurus Hoffmanni* CONYBEARE. Discovered about the year 1766 in the chalk quarries at Mont St Pierre, near Maestricht. See CUVIER *Rech. s. l. ossements foss.* v. 2, pp. 310—338. Approaching the *Monitors* in the form of Cranium.

Leiodon OWEN. Acrodont type of dentition. Teeth half the size of those of *Mosasaurus Hoffmanni*. Outer surface nearly as convex as inner, with section of crown elliptic.

Sp. *Leiodon anceps* OWEN. Teeth alone known. OWEN *Rep. Br. Assoc.* 1841, pp. 144—145. Chalk of Norfolk.

Geosaurus CUV. Teeth with crown compressed, subrecurved, anterior and posterior edges trenchant, finely serrate. Eyes with broad sclerotic plates. Vertebræ biconcave. Lithographic limestone, green sand. CUV. *Oss. foss.* v. 2, pp. 338—343.

Crocodilia OWEN.

Crocodilian remains have been found from the Lias and Oolite to the Eocene tertiary, and present differences of structure from the existing species which are greater in proportion as the strata in which they are found are more remote. In the existing species the anterior surface of the vertebral centrum is concave, the posterior convex, (*procœlian* OWEN). But in the crocodiles of the tertiary system there are two other different types; in one the position of the ball and socket is reversed, (*opisthocœlian* OWEN), in the other and more common both articular surfaces are flat or slightly concave, (*amphicœlian* OWEN).

Steneosaurus GEOFF. ST.-HILAIRE. Nostril subterminal; jaws narrow with slender, conical, sharp-pointed and equal teeth, like those of existing Gavials. Vertebræ biconcave.

Teleosaurus KŒNIG. Nostrils terminal; teeth as in preceding but thinner in proportion to their length. Vertebræ biconcave,

Both of these are from the Oolite series of secondary rocks.

Streptospondylus OWEN. Vertebræ with ball and socket articulation reversed, convexo-concave. From the Oolite of Caen, the Wealden.

Suchosaurus OWEN. Teeth arched, compressed, with two cutting edges, not serrate; the crown with longitudinal ridges terminating before the extremity of the tooth.

Sp. *Suchosaurus cultridens,* the only species known; from the Wealden: OWEN *Rep. Br. Assoc.* 1841, p. 67, and *Odontography.*

Goniopholis OWEN. Dermal plates strong and bony, quadrilateral, with a conical process received in a corresponding depression of the neighbouring plate.

Sp. *Goniopholis crassidens;* crown of teeth remarkably thick and obtuse, ribbed: vertebræ nearly flat at both ends; Wealden.

Poikilopleuron DESLONGCHAMPS. Vertebræ slightly biconcave. The posterior ventral ribs are composed of two pieces held together by ligament and channelled above; in this channel rests another rib formed like an S by its ventral portion, whilst the posterior part is in connexion with the spinal column.

Sp. *Poikilopleuron Bucklandii;* this is the only species known; it was discovered in the oolite of Caen; its length is estimated at twenty-five feet. DESLONGCHAMPS in *Mém. de la Soc. Linn. de Normandie,* 1836, VI. p. 33.

Cetiosaurus OWEN. Vertebræ biconcave, breadth and depth great in comparison of length. Wealden and lower Oolite.

Some of the species surpassed all the modern crocodiles in size, and even rivalled the whales. "In the great expanse of the coracoïd and pubic bones, as compared with the *Teleosauri* and crocodiles, the enormous *Cetiosauri* manifested their closer affinity to the *Enaliosauria.*" OWEN *Report Brit. Assoc.* 1841, pp. 94—102.

Dinosauria OWEN.

These gigantic animals made the nearest approach to mammals. The anterior thoracic ribs had a two-fold articulation to the spinal column as in crocodiles. Hence it may be supposed that the respiration was similar, and the heart with four chambers. The pectoral arch was lacertine; the sacrum composed of at least five anchylosed vertebræ. The bones of the extremities had a large proportional size for Saurians, and were provided with large medullary cavities. Hence their habits were terrestrial. See OWEN *Rep.* 1841, pp. 102—144.

Megalosaurus CUV.

Sp. *Megalosaurus Bucklandi* CUV. Teeth in distinct sockets, of which the outer rim is much the highest, compressed, conical, pointed with trenchant and serrated anterior and posterior edges; become solid in the course of development; the smooth anterior surface presents fine polished wrinkles. Vertebræ with articulating surfaces nearly flat. Probable length thirty feet, Wealden and Oolitic periods.

Hylæosaurus MANTELL. Resembled the lizards more than the crocodiles in the dental characters. Vertebræ slightly biconcave: Wealden.

Sp. *Hylæosaurus armatus* MANT.

Iguanodon CUV. Teeth resembling in shape those of *Iguana*.

Sp. *Iguanodon Mantelli* CUV. Vertebræ either flat or slightly biconcave. Probable total length twenty-eight feet. Wealden. See *Phil. Trans.* 1825, Pl. 14, CUV. *Oss. foss.* v. 2, Pl. 24, figs. 28—33.

Chelonii.

Foot-prints of land tortoises have been discovered in the New Red Sandstone, and impressions of parts of the shield in the Jura Limestone and Stonesfield Oolite. Ossified remains of extinct genera have been found in the tertiary divisions and the diluvial. Amongst the last are portions of the shield of *Colossochelys* of CAUTLEY and FALCONER, indicating an animal of 18—20 feet long, found in the diluvium of the Himalayas. (*Proceed. Zool. Soc.* 1844, p. 501.) Extinct Emydians have been found in strata as early as the Jurassic group and Wealden; Trionychians in the Lias, Eocene, &c., and turtles in the Portland stone, Wealden, Chalk, &c.

For the extinct genera and species of *Chelonians*, see CUV. *Ossem. foss.* v. 2, pp. 224—249, and the memoirs of OWEN, cited p. 321.]

CLASS XVI.

BIRDS (*AVES*)[1].

BIRDS are vertebrate, warm-blooded, oviparous animals that breathe by means of lungs. Their heart has two ventricles and two auricles. Their bill projects forwards, is covered with horn

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[1] Of the numerous works on birds we here notice some of the most distinguished:

BÉLON *l'Histoire de la Nature des Oyseaux avec leurs descriptions et naifs portraicts*, Paris, 1555, folio.

RAJI *Synopsis methodica Avium*, Londini, 1713, 8vo.

BRISS.;—BRISSON *Ornithologia sive synopsis methodica sistens Avium divisionem. Cum figuris aen.*, Parisiis, 1760, 6 Vols. 4to. (French and Latin text; very good and numerous figures.)

LATHAM'S *General Synopsis of Birds*, 3 Parts, London, 1781, 4to; *Supplement*, ibid. 1792—1802, 2 Vols. *Index ornithologicus*, Londini, 1790, 2 Vols.

BUFF. *Pl. enl.*—DE BUFFON *Hist. nat. des Oiseaux.* (The plates, generally cited under the title of *Planches enluminées*, are coloured plates, drawn and engraved by the same artist, MARTINET, who executed the figures of BRISSON'S work. They are 984 in number, and are subjoined to an edition from the *Imprimerie royale*, 1770—1786 (10 parts, in 4to or small folio).

TEMM. *Pl. col.*—C. J. TEMMINCK et MEYFFREN LAUGIER *Nouveau Recueil de Planches coloriées d'Oiseaux pour servir de suite aux Planches enl. de* BUFFON, Paris, 1838, 5 Vols. (in 4to or small folio, published from 1820—1838, 600 plates in 102 numbers).—A third collection of coloured plates, to serve as the completion of the two former, was begun in 1845, under the title of *Iconographie ornithologique. Nouveau Recueil général de Planches peintes d'Oiseaux*, par O. DES MURS. It was concluded with the first part (72 plates) in 1849, or at least has been interrupted hitherto.

R. P. LESSON *Traité d'Ornithologie*, Paris, 1831, 8vo, 1 Vol. and Atlas.—The plates, which are taken from the *Dict. des Sc. nat.* in 60 Vols., surpass most of the rest in that well-known work, and will be often cited by us.

For the birds of Europe we note:

C. J. TEMMINCK *Manuel d'Ornithologie*, 2nd edition, 4 Parties, Paris, 1820—1840, 8vo.

J. A. NAUMANN'S *Naturgesch. der Vögel Deutschlands, umgearbeitet von* J. F. NAUMANN, 8vo, Leipzig, 1822—1844. 12 Thle. (with 337 very accurate, coloured plates; of this work some supplements have appeared subsequently.)

As a systematic review of this extensive class there appeared not long ago G. R. GRAY *The genera of Birds. Illustrated with 317 plates.* 3 Vols. 4to, London, 1844—1849.

A chief work for the physiology of birds is still F. TIEDEMANN *Anatomie und Naturgesch. der Vögel*, 2 Bde. Heidelberg, 1810, 1811, 8vo, being the second and third

and edentulous. The anterior limbs are changed into wings, whilst the posterior serve exclusively for standing and running.

We will, in the first place, treat shortly of the skeleton. The dorsal vertebræ are mostly immoveably connected with each other, sometimes even the bodies of some of them have partially coalesced. The cervical and caudal vertebræ alone admit of motion. The cervical region of the vertebral column is the longest, and often surpasses the whole of the remainder in length. The number of the cervical vertebræ is constantly greater than in mammals, and in reptiles also with the exception of the fossil genus *Plesiosaurus;* for there are at least nine, usually between ten and fifteen of them, and in the wading and swimming birds still more (in the swan twenty-three). The first two cervical vertebræ are shorter than the rest; the first has nearly the form of a ring, and receives, in a deep pit, the single articular tubercle of the cranium situated below the great occipital foramen. The rest of the cervical vertebræ have elongated bodies; the perforated transverse processes form a canal through which the vertebral artery and the cervical portion of the sympathetic nerve pass. The anterior branch of this transverse process is prolonged downwards into a stiliform appendage; this part, lying in front of the *foramen transversarium*, may be compared with a rib; it is only the posterior part that corresponds to the transverse processes of the dorsal vertebræ. The dorsal vertebræ are provided with moveable ribs. They are much less numerous and also shorter than the cervical vertebræ, hence the dorsal region does not usually form more than a fourth part of the length of the vertebral column, and in birds with a very long neck, as the stork, only about an eighth part. The transverse processes are broad, and at their extremity, on a surface covered with cartilage, receive the tubercles of the ribs. The spinous processes of these vertebræ are long and ridge-like and close upon each other. The anchylosed lumbar and sacral vertebræ form the region of the spinal column which lies between the long *ossa innominata;* they are usually from ten to fourteen in number. Finally, the tail forms the smallest part of the vertebral column, and commonly

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parts of the *Zoologie zu seinen Vorlesungen entworfen* of this Nestor of modern anatomy, which learned work has never been completed. See also the article *Aves* of OWEN in TODD'S *Cyclopædia of Anatomy and Physiol.* I. 1836, pp. 264—358.

consists of seven or eight vertebræ which are moveably connected with each other, and, with the exception of the last, are very short. The last vertebra has no cavity for the reception of the spinal marrow, and presents the form of a compressed disc; it supports the tail, and sometimes differs in form according to the difference of sex, as in the Peacock.

The number of pairs of ribs corresponds of course to that of the vertebræ which are regarded as dorsal vertebræ. The anterior ribs do not extend as far as the sternum[1]. These imperfect ribs are usually attached to the transverse processes alone of the vertebræ, whilst the rest of the ribs are attached, each by its head, to the same vertebra whose transverse process receives its tubercle. The connexion of these ribs with the sternum is effected not by a cartilaginous but by a bony piece, so that they are composed of two bones,—a vertebral piece and a sternal piece. The vertebral pieces of most of the ribs (except the anterior and one or two last) have at the posterior margin of their lower part a flat appendage which mounts obliquely upwards and lies over the succeeding rib; in some birds this process continues a separate bone.

The sternum is very large (with the exception of the genus *Apteryx*), and covers not only the thoracic cavity but a large part of the abdominal likewise. It is convex forwards and at the upper part excised on each side for the reception of the coracoïd bone. In the middle of the anterior surface there is a projecting bony plate running longitudinally, which is absent in the Ostrich, the Casuary and the genus *Apteryx* alone.

The anterior limbs are securely connected with the sternum; there are on each side two clavicles. The proper clavicle (*os furculare*) is thin and curved; it runs obliquely from the shoulder-joint downwards and backwards where it meets that of the opposite side, and commonly coalesces with it completely. This bone is seldom attached immediately to the sternum, but is usually free, and connected with it only by a ligament or by cartilage. In the nocturnal birds of prey and some species of *Psittacus* this bone is a very thin spine, and in certain species of the last genus it is wanting,

[1] OWEN regards the vertebræ to which these ribs are attached as cervical, so that thus the number of these would be increased by one, two, or three. *On the nature of Limbs*, London, 1849, 8vo, p. 103.

and its place supplied by a ligament[1]. The two other clavicles (*claviculæ coracoïdeæ*) are never absent; they lie more behind and on the outside, are flatter, broader and shorter, and are attached to the lateral margin of the uppermost part of the sternum. In conjunction with the long thin scapula these clavicles form the articular surface for the reception of the head of the humerus. In many birds there is, in addition, a small bone present, which rests upon the capsular membrane of the upper-arm bone at the side of the scapula[2].

The upper-arm bone (*humerus*) is cylindrical; when the bird does not expand its wings for flight this bone is directed backwards. It is especially long in the pelican, where it extends as far as behind the pelvis, short in gallinaceous birds, where it scarcely reaches to the last rib. In the ostrich it is long, in the casuary, on the contrary, very short; also in the penguins (*Aptenodytes*) it is short and very flat besides. To the upper-arm bone succeed the two bones of the fore-arm, of which the undermost and thickest is the ulna (*ulna* s. *cubitus*), the uppermost the *radius;* these bones also are particularly long in the pelicans, and especially in the frigate-bird (*Pelecanus aquilus* L.). At the upper extremity of the ulna is usually seen a small cubital process (*olecranum*), and behind it there is often a pisiform bone or arm-pan (*patella brachialis*)[3]. The wrist (*carpus*) is formed by two short little bones. At its anterior margin the stiliform thumb is attached, which consists of one or two joints (*phalanges*). Next to this lie two tubular metacarpal bones, which have coalesced both above and below. At the lower end of these bones are two fingers, of which the outermost is small and consists of only one awl-shaped joint, whilst the innermost, which extends far beyond the two other fingers, is composed of two, or more rarely of three joints, of which the first is broad and flat.

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[1] Especially in the smaller species, as *Psittacus pullarius;* compare KUHLMANN *De Absentia furculæ in Psittaco pullario. Diss. inaug.* Kiliæ, 1842, 8vo.

[2] NITZSCH *Osteografische Beiträge zur Naturgesch. der Vögel,* Leipzig, 1811, s. 83 and foll.; the author, who first noticed this bone, names it *Scapula accessoria* or *os humero-capsulare.*

[3] In *Aptenodytes* there are two such ossicles; see J. F. BRANDT *Beiträge zur Kenntniss der Naturgesch. der Vögel mit besonderer Beziehung auf Skeletbau.* St. Petersburg, 1839, 4to, Tab. XII. figs. 5, 6.

The iliac bones in birds coalesce with the lumbar and sacral vertebræ. They are elongate and deeply excavated on the surface turned towards the abdomen, the cavities receiving the kidneys. The spine-like pubic bones (*ossa pubis*) proceed backwards and are not connected with each other, except in the ostrich. The ischiadic bones (*ossa ischii*) are shorter and broader, they extend from the cavity of the hip-joint (*acetabulum*) backwards, parallel to the pubic bones with which they coalesce at their extremity. Between the pubic and ischiadic bones is left a large longitudinal aperture (*foramen obturatorium*), which is sometimes divided by a bridge connecting the two bones into a smaller anterior and an elongated posterior aperture. Another large aperture in the pelvis lies more forwards and nearer the back, behind the acetabulum, between the iliac and ischiadic bones (*foramen ischiaticum*).

The thigh-bone (*femur*) is shorter and thicker than the leg-bone (*tibia*), nearly cylindrical, and slightly curved forwards; there is a single *trochanter*, on the outside of the head of the bone, which is large and projects above this head. In birds that cannot fly, the Ostrich, Casuary, and *Apteryx*, in which the fore limbs are so feebly developed, the thigh-bone is very strong and surpasses the arm-bone (usually much longer) in thickness, and in the Casuary and *Apteryx* in length also, remarkably. The tibia is constantly the longest bone of the hind limbs; close to this bone lies on the outer edge at the upper part a short and imperfect fibula, which, coalescing with the tibia, terminates thin downwards, without extending to the tarsus. A knee-pan (*patella*) is always, or almost always, present; in the Ostrich there are even two, one above the other.

In some water-birds (*Colymbus* LATH., *Podiceps* ejusd.) the tibia terminates above in a pointed triangular process, keeled in front, upon which in *Podiceps* a patella also triangular lies, whilst in *Colymbus* this process is broader, and seems to supply the place of the absent patella[1]. The region of the tarsus and metatarsus is represented by a single bone, of which the upper extremity strongly resembles the head of the human tibia, and in which two cavities, with a projecting line between them, receive the two articular

[1] Compare MECKEL *Syst. d. vergl. Anat.* II. s. 131, and R. WAGNER in HEUSINGER'S *Zeitschr. f. d. organ. Physik.* I. s. 586, Tab. XIII.

tubercles of the inferior extremity of the tibia. Most birds have four toes, three anterior and one posterior. This last toe, named the posterior thumb (*hallux*) is not seldom wanting; when present it is supported by a small cylindrical bone, which is attached to the posterior surface of the principal bone of the tarsus. This bone (*tarso-metatarsal* OWEN) becomes broader at its lower extremity and divides into three processes, to which the three anterior toes are attached. The number of joints or phalanges usually increases in birds from the thumb, which has two, to the innermost, middle and outermost, according to the numbers three, four, five; the middle toe, although it has a joint less than the outermost, is generally the longest of all.

The cranium is connected with the first cervical vertebra (as in the *Reptilia Haplopnoa*, p. 255) by an unpaired articular tubercle situated under the large occipital foramen; this occipital foramen is placed lower than in the fishes and reptiles. The internal cavity of the skull is round, and the posterior hollow, for the reception of the cerebellum, is separated from the anterior in which the cerebrum lies; the two occupy entirely the internal cranial space. The bones of the cranium anchylose with each other at an early period; this is less the case, or not at all, with those of the face. In the ostrich, however, the cranial bones remain longer distinct, in which, on that account, they have been especially investigated, as well as in young birds and in the embryo. The occipital bone consists of four pieces; the body, two lateral parts, and the occipital scale. The body of the sphenoïd is long, terminating in a point forwards, and supports there the bony partition of the orbits, the laminiform ethmoïd. On the back part of this body the great *alæ* rest, which are soon anchylosed with it; they form the posterior margin of the orbits, are connected with the temporal and frontal bones, and on the outer surface of the cranium assist in forming a process that is situated behind the orbit. The lesser alæ continue in part membranous and are situated more upwards, round the large aperture for the passage of the optic nerve. The parietal bones are short and broad; the frontal bones are much larger, and form a considerable part of the upper surface of the skull. When the cranium is viewed on the inferior surface it presents much resemblance with that of the lizards (for instance, with that of the genus *Varanus*). From the sides of the body of the

sphenoïd there pass obliquely backwards and outwards the so-named *ossa omoïdea* of HÉRISSANT. They are longitudinal, stile-shaped or flat bones, which with their broader anterior extremity lie towards the palate bones and are connected with them by articulation, whilst the posterior extremity is connected moveably with an articular surface on the inner margin of the quadrate bone close to its inferior extremity. These bones are the *ossa pterygoïdea* or inferior wings of the sphenoïd and correspond to the *ossa pterygoïdea interna* of fishes and reptiles. The quadrate bone of birds is large and divided above into two arms; of these the innermost mounts upwards towards the orbit and terminates freely, the outermost is connected by articulation with the temporal bone; below the quadrate bone is connected with the articular cavity of the lower jaw by an elongated articular surface, which runs obliquely inward and forward. By means of the pterygoïd bones the motion of the quadrate bones is communicated to those of the palate and also to the upper jaw; when the under jaw descends the quadrate bone is pushed forwards and the upper jaw lifted up; when, on the contrary, the mouth is closed, the quadrate bone during the raising of the lower jaw is drawn backwards and the upper jaw downwards. To this also the malar bone contributes, which, elongated and stiliform, extends downwards along the margin of the lower jaw, and is connected by a part that always remains distinct (*os quadrato-jugale*) to an articular surface which the quadrate bone presents on its inferior extremity. The intermaxillary bones are thin and flexible above, in front of the frontal bones; in some birds the flexion occurs lower, more towards the end or at the middle of the upper jaw[1]. The greater part of the upper jaw is formed by the single intermaxillary bone, of which the ascending portions (*processus nasales*) lie close together between the nasal apertures and are connected with the frontal bone. On the outside of these bones the nasal bones are situated, and more behind and externally on the anterior margin

[1] Compare HÉRISSANT *Observations anat. sur les mouvements du bec des Oiseaux, Mém. de l'Acad. royale des Sc. de Paris*, 1748, pp. 345—386, with figures; CUV. *Leç. d' Anat. comp.* II. p. 589, IV. pp. 99—113; and especially NITZSCH in MECKEL'S *Archiv f. Physiol.* II. s. 361—379, s. 470, III. s. 384—388.

On the bony head of birds compare GEOFFROY ST.-HILAIRE *Ann. du Mus.* X. 1807, pp. 342—360, Pl. 27 (without adopting all the definitions of the bones, some of which are quite wrong), MECKEL'S *Syst. d. vergl. Anat.* II. 2, s. 155—237, &c.

of the orbits the lacrymal bones, which, in the parrots, unite with the process (p. 331) behind the orbits to form a ring. In the other birds the orbit is not closed below; the malar bone lies, as we have already stated, much lower, and does not contribute to bound the orbit.

The jaws of birds have no teeth, and are covered with a horny fibrous investment. This is harder in the birds of prey, and in those that feed on hard fruits or nuts, as the parrots, the cross-bills (*Loxiæ*) &c., or perforate the bark of trees with their bill, as the woodpeckers. The hindermost part of the bill has a softer investment, which is named the cere (*ceroma*). When this part on the bill is not concealed under the feathers of the head, but is large and separated from the anterior hard part by a transverse fold, the bill is named *rostrum cerigerum*. On the other hand, the bill has a softer covering and greater sensibility in birds which have to seek their food in mud or at the bottom of water, as in the ducks.

Birds have salivary glands, which vary in number and development in the different orders. They lie partly on each side under the tongue, partly behind the anterior margin of the under jaw, and also in the angle of the mouth under the malar bone. In the woodpeckers, the hindmost submaxillary gland extends as far back as the occiput; it has long excretory ducts, which terminate in a common aperture at the forepart of the mouth[1].

The œsophagus has internally on the mucous membrane longitudinal folds. The muscular tunic, which covers the mucous membrane, consists for the most part of circular or transverse fibres; these form an outer layer, whilst the inner, less developed, is formed by longitudinal fibres. In many birds the œsophagus has an expansion which is sometimes not sharply distinguished from the remaining part, but in others, especially in the gallinaceous birds and parrots, is sacciform. The name of crop (*ingluvies*) has been given to this part; it lies usually on the right side of the neck in front of or within the *furcula*. In the crop the food undergoes a softening, and is penetrated by the fluid secreted by the numerous mucous glands of the part. In the pigeons two such sacs are found, one on

[1] CUVIER *Leç. d'Anat. comp.* III. pp. 220—222; MECKEL'S *System der vergl. Anat.* IV. s. 403—406, s. 465, 466; J. MUELLER *De glandular. secern. structura penitiori*, Lipsiæ, 1830, fol. pp. 58—60, Tab. VI. figs. 6—8.

the right and one on the left side of the lowest portion of the œsophagus. Behind the crop the œsophagus is generally narrower than in its anterior part, and afterwards passes into the stomach.

The stomach of birds consists of two divisions. The first division, the glandular stomach (*proventriculus, bulbus glandulosus*), has usually the form of an oval expansion of the lowest part of the œsophagus. Under the external membrane, which, as a duplicature of the peritoneum, covers both stomachs, there lies in the glandular stomach a thin muscular coat, and to this succeeds on the inside a layer of numerous glandules, whose apertures are visible to the naked eye on the inner surface of the stomach. These glands are small elongated blind sacs, which stand as eversions of the mucous membrane with their long axis perpendicular to the long axis of the stomach, and thus are nearly horizontal; sometimes their blind extremity is branched.

In the glandular stomach the gastric juice is secreted; at the inferior extremity the little glands diminish in number, or even disappear entirely before the commencement of the second division. This second division is named the muscular stomach. The muscular tunic is here developed in a much greater degree; its fibres radiate from two tendinous plates, of which the one is situated on the anterior, the other on the posterior surface of the stomach. Internally, this stomach is covered with a horny *epithelium*, which, particularly in the gallinaceous birds, where the muscular tunic is also very thick, possesses much rigidity[1]. The muscular stomach is round and flat; in birds of prey it has a thinner muscular tunic. By the action of the muscular fibres the food is pressed and bruised between the horny covering of the inner surface, which in other animals, especially in mammals, is effected previously by mastication. According to A. RETZIUS, this muscular stomach or gizzard is to be considered as a development of that part of the stomach of man and mammals, which is called by WILLIS the *antrum pylori*.

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[1] Sometimes on this horny covering spines are placed in longitudinal rows, as in the muscular stomach of the *Condor* (HARLAN *American Philos. Transact.* III. 2, p. 466), or tooth-shaped tubercles, as in *Procellaria glacialis*, CARUS *Tab. Anatomiam comp. illustrantes*, IV. Tab. VI. figs. 15, 16.

On the right side of the stomach and at the upper part lies the pylorus. Here, in some birds (heron, pelican, &c.) is found another distinct dilatation or supplemental stomach, an appendage which occurs also in the crocodile, whose round sacciform stomach on the whole resembles that of birds[1].

The first part of the intestinal canal, into which the gall ducts and those of the pancreas open, is wider than the rest of the small intestines. Here the intestinal canal forms a transverse flexure, which turns back again at an acute angle, and thus forms a loop in which the pancreas is situated. After this the small intestines form some curvatures and then pass into the short large intestine, which ends in a bladder-like expansion, the so-named *cloaca*. In proportion to the body the intestinal canal is usually much longer than in fishes and reptiles, but shorter than in mammals. It surpasses the length of the body, measured from the extremity of the bill to the termination of the coccyx, mostly three, often five times[2]. Commonly there are found, where the large intestine begins, two cœca, which run forwards; also the small intestine at its passage into the large is bounded by a constriction arising from an annular fold. The two cœca or lateral appendages of the large intestine are especially long in the ducks; on the other hand, they are very short in the diurnal birds of prey. They are wanting in the kingfisher, the hoopoe, the parrots, and some other birds[3]. In the herons only one such cœcum is found, which lies backwards. The internal mucous membrane of the small intestine has villi as a rule, which sometimes extend into the rectum and the cœca. In the small intestine, however, especially at its commencement, the villi are more numerous, longer and finer. Only seldom are these

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[1] See on this third stomach OWEN, TODD'S *Cyclopæd.* I. p. 322, F. S. LEUCKART *Zoolog. Bruchstücke,* II. 1841, s. 64—71, Tab. 3, 4.

[2] Compare the tables in CUVIER *Leç. d'Anat. comp.* 2e édit. IV. 2, pp. 182—208.

[3] The two cœca are often of unequal length on the two sides; see R. WAGNER *Beiträge zur Anat. der Vögel,* s. 294, 295, *Abhandl. der math. physikal. Klasse der Akad. zu München,* II. 1836. OWEN has treated copiously of these cœca, l. l. pp. 323, 324.

Besides the cœca of the large intestine there is often found at the small intestine a blind appendage, usually short, a *diverticulum*, which is the remain of the vitello-intestinal duct. MACARTNEY *Phil. Transact.* 1811, p. 207, R. WAGNER *Beitr. z. Anat. d. Vögel,* l. l. s. 286—290; this part is most developed in the genera *Scolopax* and *Numenius.*

villi wanting, as in many singing-birds, when they are replaced by zigzag longitudinal folds sometimes forming rhomboidal meshes, which indeed may be present simultaneously with villi, or in the posterior part of the small intestine may take the place of the villi which exist in the anterior part.

The rectum ends with a muscular ring in the *cloaca*, a cavity surrounded by strong circular muscular fibres, which, as in most of the lizards, has a transverse external opening. Into this cavity also the ureters open, and, in males, the efferent vessels; in female birds the oviduct terminates at its left side. Also behind and between the ureters, behind a projecting transverse fold in the *cloaca*, there opens a sac which, after its discoverer FABRICIUS AB AQUAPENDENTE, is named *bursa Fabricii*. This part is a blind sac, of which the base is turned upwards and lies behind the rectum; it has a thin layer of muscle with fibres crossing in various ways; the internal or mucous membrane is thick, whitish, and presenting longitudinal, projecting folds. This part often appears to decrease in older birds, or at least to be developed less than might be expected from the size which it has in young ones; it occurs in both sexes without remarkable difference in the development[1].

The liver is large[2], and almost always deeply divided into two

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[1] Hence the opinion falls to the ground that this part belongs to the system of the organs of propagation, as, for instance, that of FABRICIUS, who thought that in copulation the sperm was received in this organ of the female bird, and was kept there for the successive impregnation of the eggs. Other writers suppose this part to be an arrangement for secretion, and compare it with the glandular sacs which in some mammals are situated near the *anus;* others see in this bladder a *vesica urinaria*. HUSCHKE, the latest writer who, as far as I know, has expressed an opinion respecting it, thinks that the *bursa* is the bladder into which, during a certain period of development, the excretory ducts of the primordial kidneys or *corpora wolfiana* open, and compares it in consequence to the *vesica urinaria* of fishes which is situated upon the *rectum*, i. e. at the backside of it (see above, p. 37). The *bursa Fabricii* is to be seen figured in R. DE GRAAF *Opera omnia*, Amstelæd. 1705, 8vo, Tab. XVI, described p. 243, in TANNENBERG *Observ. circa partes genitales masculas avium*, Gottingæ, 1789, 4to, Tab. III. fig. 2 *d* &c. Compare also GEOFFROY ST.-HILAIRE *Mém. du Mus.* IX. 1832, p. 397, who regards the *bursa* as the excretory duct (?) of the *Glandulæ Cowperi*, A. A. BERTHOLD in *Nov. Act. Acad. Cæs. Leop. Carol.* XIV. 2, 1829, s. 903—918, and ÆM. HUSCHKE *de bursæ Fabricii origine*, Jenæ, 1838, 4to.

[2] In some birds the weight of the liver forms $\frac{1}{20}$th, in the peewit $\frac{1}{13}$th, and in a saw-bill (*Mergus albellus*) even $\frac{1}{10}$th of that of the whole body. TIEDEMANN'S *Zoologie*, II. s. 492.

principal lobes connected only by a small strip, of which that of the right side is commonly the larger. It is attached to the sternum, the stomach and the air sacs by duplicatures of the peritoneum, occupies the upper region of the abdomen, and is for the most part covered by the sternum. A gall-bladder is generally present, and is wanting only in a few birds, namely, the ostrich, the pigeons, most species of parrots, the *toucans*, &c. Also in some individuals it has not been found, whilst it has been present in others of the same species. It lies commonly between the two lobes of the liver and nearer to that of the right side. From each of the lobes a gall-duct proceeds; the two mostly unite to form a common duct which opens into the duodenum, distinct from the duct of the gall-bladder.

The pancreas is whitish red, elongate and large, and usually divided into two lobes, often even double. Commonly it has two, only seldom three ducts, which do not unite with the gall-ducts, but open separately into the duodenum, partly in front of, partly between these last-named ducts. The spleen is small, oval or spherical, and lies far forward, close to the glandular stomach.

With respect to the lymphatic system, lacteals are very numerous in the intestinal canal. Those of the rectum and of the two cœca are for the most part in connexion with the veins of the pelvis[1]; those of the small intestines form, with the lymphatics of the rest of the viscera and of the hind limbs, a large plexus on the *arteria aorta* and *cœliaca;* from this arise two thoracic ducts, each of which runs to the superior vena cava of its own side, and empties itself there under the junction with the jugular vein, having first received the lymphatics of the neck and of the wing. Conglobate or lymphatic glands are not found in the mesentery; hitherto they have been met with only in the neck and the upper part of the thoracic cavity[2].

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[1] At the lower part of the pelvis there are in some birds (the goose, swan, casuary, &c.) two small vesicular lymphatic expansions on which STANNIUS observed muscular fibres, but which were not seen to pulsate rhythmically, like the lymphatic hearts of reptiles; from these expansions a vein arises; see them figured from the goose in PANIZZA *Observazioni antropo-zootomico-fisiologiche,* Pavia, 1830, fol. Tab. IX. figs. 3, 8; compare STANNIUS in MUELLER'S *Archiv,* 1842, s. 449—452.

[2] HEWSON first discovered and described the lymphatic system in birds, *Philos. Transact.* Vol. 58, and also in his *Experimental Inquiries,* II. London, 1774, pp. 64—71; in our century the existence of this system was for the most part denied by MAGENDIE, according to whom lymphatics exist in the neck only; he was, however,

The heart of birds is, like that of mammals, divided into two perfectly distinct chambers. It rests on the sternum, included in a thin pericardium, lies along the middle of the body in a straight direction and has an elongated conical form, terminating in a point backwards. The left ventricle has very thick and strong walls, and, since it is longer than the right, the apex of the heart is entirely formed by it. In the right ventricle of the heart the walls are much thinner; there is here, in place of the tricuspid valves of the heart of mammals, a single valve, very muscular and thick, which is situated in the upper part of the ventricle in front of the venous aperture or the opening of the cardial sinus (auricle); it has a triangular form, and descends obliquely with its free inferior margin from the left side to the right. In the left ventricle there are usually three or two membranous valves (*valvulæ mitrales*) situated in front of the entrance from the auricle[1].

From the heart arises the large artery (*aorta*), which, after having given off at its origin the coronary arteries of the heart, divides almost immediately into two principal branches. The right branch, which is the widest, presently divides into a descending artery, which is situated more downwards, bends to the right and runs backward under the vertebral column, and into an innominate or subclavian artery, destined for the anterior parts of the body. The left branch is the left innominate or left subclavian artery. Commonly there arises a carotid artery on each side; yet in the singing birds and some others one only arises on the left side and the right artery is then subclavian alone. In the *flamingo* (*Phœnicopterus*) the single carotid artery is, on the contrary, the branch of a right innominate artery[2]. The carotid or the two carotid arteries ascend upon the inferior surface of the cervical vertebræ; when there is only one then it divides on reaching the head into a right and left branch. The particularly large size of the external thoracic artery (*art. thoracica s. mammaria*

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entirely refuted by accurate investigations, particularly of LAUTH *Ann. des Sc. nat.* III. 1824, pp. 381—410, Pl. 21—25 and of PANIZZA, l. l.

[1] Compare on the heart of birds R. LOWER *Tractatus de corde*, Lugd. Bat. 1708, 8vo, pp. 60, 61, BLUMENBACH *Kleine Schriften*, s. 29—32, TIEDEMANN *Zoologie*, II. s. 557—559, and the general works on comparative anatomy of CUVIER, MECKEL, &c. See also OWEN, l. l. pp. 330, 331.

[2] Compare MECKEL in his *Archiv f. Anat. u. Physiol.* 1826, s. 19, 20, and also C. L. NITZSCH *Observationes de Avium arteria carotide communi*, Halae, 1829, 4to.

externa) in birds is remarkable, it is wider than the brachial artery, which is to be explained by the powerful development of the great pectoral muscle. In place of one iliac artery on each side from the descending *aorta* for the hind limbs, two arteries are found in birds, of which the anterior (*arteria cruralis s. femoralis*) is small and runs above the pelvis under the last rib backwards, whilst the posterior much larger (*arteria ischiadica*) is the principal artery of the hind limbs, which previously gives off the middle arteries of the kidney. After this the *aorta* is much diminished in size (*art. sacra media*). In birds arterial wonder-nets are often present, as a *rete mirabile temporale* formed by the ophthalmic artery, an external branch of the artery of the brain (*arteria carotis interna*), a wonder-net at the pecten within the eye-ball, one by the anterior tibial artery, &c.[1] There are always two superior *venæ cavæ* and one inferior, which return the blood to the right sinus of the heart. The right jugular vein is wider, in some birds much wider than the left, which close to the head is connected with it by a transverse branch and conducts to it a part of the blood[2].

There are two lungs present in birds, which lie upon the dorsal surface of the cavity of the thorax, attached to the ribs and dorsal vertebræ and not covering the heart; they are not divided into lobes. The two *bronchi* are, in proportion to the *trachea*, short; they penetrate the upper part of the lungs on their anterior surface, and are perforated by some large apertures which lead into the wider branches or bronchial tubes of the first order, the extremities of which open on the surface of the lungs and pass into the air-sacs which are in connexion with the lungs. These bronchial tubes again are perforated by smaller apertures which lead into smaller bronchial tubes which anastomose variously with each other so as to form a network of tubes. The walls of these tubes are

[1] On the arterial system of birds compare F. BAUER *Disquisitiones circa nonnullarum avium systema arteriosum*, c. fig., Berolini, 1825, 4to; E. HAHN *Commentatio de Arteriis anatis*, cum tabulis, Hannoveræ, 1830, 4to; and H. BARKOW *Anatomische Untersuchungen über das Schlagader-system der Vögel*, MECKEL'S *Archiv für Anatomie und Physiol.* 1829, s. 305—496, Taf. VIII—X.

[2] A figure of the principal veins, with the arteries, in the fowl is to be found in the *Catalogue of the Physiol. Series of comp. Anat. contained in the Museum of the College of Surgeons*, II. 1834, Pl. 25; the veins of the swan are in part figured by OTTO in CARUS *Tabul. Anat. comp. illustr.* VI. Tab. VI. fig. 1.

covered by a network of multangular cells, in each of which much smaller cells are situated, which are surrounded by the capillaries of the lungs and in which the chemical change from venous to arterial blood takes place in respiration[1]. Through the apertures of the bronchial tubes on the surface of the lungs the air passes into large air-sacs which are situated partly in the thoracic partly in the abdominal cavity, and which conduct air to the hollow bones. They are supplied with blood vessels, but these are not branches of the pulmonary arteries and moreover are not to be compared in number and development with the blood-vessels of the lungs. So that if to the air-sacs, as appendages of the lungs, any participation in the respiratory function be ascribed, this cannot in any case be great. But the air-sacs form reservoirs of air for breathing, and as they receive air from the lungs, so they can return it to them again for inspiration[2].

That birds have hollow bones filled with air had been observed by earlier writers, by FABRICIUS AB AQUAPENDENTE, BORELLI, and others; but still our celebrated countryman P. CAMPER was the first (whilst JOHN HUNTER almost contemporaneously or shortly after made the same discovery) who proved that these hollow bones communicate with the air-sacs, and therefore, mediately, with the lungs[3]. The humerus, sternum and cranial bones are

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[1] The finer structure of the lungs of birds, such as we have here described it, was first made known by the investigations of A. RETZIUS, communicated to the Academy of Sciences at Stockholm in 1831, and copied in FRORIEP'S *Notizen*, Bd. XXX. s. 1—9, figs. 9—11, 1838, 4to, pp. 56—58; see also LEREBOULLET *Anat. comp. de l'Appareil respiratoire*, Strasbourg, 1838, 4to, pp. 56—58; ED. WEBER speaks of fine, closed terminal tubes; see *Amtlicher Bericht über die Versammlung deutscher Naturforscher in Braunschweig*, 1845, s. 75; RAINEY *Minute Anat. of the Lung of the Bird, Medico-Chirurg. Transact.* sec. Ser. XIV. pp. 47—58, Pl. 1; WILLIAMS' article *Respiration* in TODD'S *Cyclop. of Anat. and Physiol*, *Suppl.* 1855, pp. 276—278.

[2] See on these air-sacs CUVIER *Leçons d'Anat. comp.* IV. pp. 327—330, and the second edition of DUVERNOY, VII. pp. 125—128, TIEDEMANN, l. l. s. 601—618, OWEN, l. l. pp. 342, 343, and especially NATALIS GUILLOT *Mém. sur l'Appareil de la Respiration dans les Oiseaux*, *Ann. des Sc. natur.* 3e Série, v. 1846, *Zoologie*, pp. 25—87, Pl. 3, 4.

[3] Compare on the hollow bones P. CAMPER in the *Verh. van het Bataafsch Genootschap te Rotterdam*, I. bl. 235—244, with figures. (Also, with additions, in the French edition of his works, Tom. III. pp. 457—496.) His discovery was made in the year 1771. In the same year that it was made public in the Transactions of the Dutch Society, the observations of HUNTER appeared in the *Philosoph. Transact.* 1774; see

those which are most usually hollow, often also the vertebræ (with the exception of the first cervical), the ribs, the scapulæ, the clavicles, the pelvis, the thigh-bones. Rarely, however, are the thigh-bones hollow when the upper-arm-bones are not so. The radius and ulna, tibia and fibula, as also the bones of the wings and feet which succeed to these, are, on the other hand, almost always filled with marrow, to which the genus *Buceros*, according to the observations of NITZSCH, forms a remarkable exception, in which even the phalanges of the toes are pneumatic[1]. The cranial and facial bones receive the air not from the lungs, but in part immediately from the Eustachian tube and the cavity of the tympanum[2], in part from the nasal cavities which conduct it to a space situated under the eye, from whence it penetrates further into the cavities and cells of those bones[3].

We have still, in this place, to speak of the wind-pipe (*trachea*) of birds, a part of the respiratory apparatus which we consider in the last instance in order that we may unite with it conveniently

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also his *Observations on certain parts of the Animal Œconomy*, edited by R. OWEN, London, 1837, pp. 176—186. For extensive investigations at a later period we are indebted to NITZSCH *Osteografische Beiträge*, Leipzig, 1811, s. 1—62. ALBERS and G. VROLIK observed that birds can breathe through the perforated or broken humerus and so continue to live after the ordinary passage for the air has been interrupted by compressing the wind-pipe; REIL'S *Archiv*, VI. s. 469—490. Compare also JACQUEMIN *Recherches physiol. et anat. sur la respiration, Mémoire sur la pneumaticité des Oiseaux*, etc., *Nov. Act. Acad. Cæsar. Leop. Carol.* Tom. XIX. 1839, Pl. 2, pp. 288—333, Tab. 59—61.

[1] MECKEL'S *Archiv f. Anat. u. Physiol.* 1826, s. 618 and foll.

[2] On the inside of the lower jaw, behind the articular surface for the quadrate bone, is the aperture by which the air from the tympanic cavity has access to them. Here is sometimes a membranous duct present which leads from the cavity of the tympanum to the aperture; in many singing birds this duct is replaced by a bony tube which was discovered by NITZSCH and named *siphonium; Osteogr. Beitr.* s. 30—32. In *Apteryx*, an entirely abnormal genus of birds from New-Holland, where also the air-cells do not extend into the abdominal cavity, the under jaw is the only bone in which any trace of *pneumaticity*, elsewhere so common in birds, is met with; R. OWEN *Transact. Zool. Soc.* II. 4, p. 286.

[3] Whenever the use of the hollow bones of birds is discussed, the opinion offered by CAMPER is usually the first that is considered, viz. that the air that has been warmed and rarified diminishes the specific gravity of the bird and so makes it fitter for flying. But it must not be forgotten, that young birds do not yet possess these cavities though they fly very well, that many, especially small birds, have no hollow bones, and that bats are able to fly without any such provision.

the consideration of the vocal organs. The wind-pipe of birds differs from that of other vertebrate animals that breathe by means of lungs in regard to the part it takes in the production of the voice. In the mammals, and also in the reptiles, the trachea merely conducts the air which is to serve for the production of sound; in birds, on the contrary, it conducts the voice itself, which is not produced at the upper end of the wind-pipe, in the larynx, but at its inferior extremity, where it divides into the two *bronchi*. Here there exists an apparatus which has been improperly named *inferior larynx*[1]. Seldom only is the organ for the production of sound situated at the lower part of the trachea itself, above its division into the bronchi, as in *Tamnophilus* and *Myiothera;* in *Steatornis*, conversely, MUELLER found that the inferior larynx is seated in each of the *bronchi* at some distance below the division, and thus is double[2]. In most birds the rings of the bronchi are incomplete; and on the inner surface, where they are turned towards each other, there is a membrane which is tense and capable of vibration. From the origin of the bronchi there ordinarily passes a bony lamina transversely from before backward and extending upwards into the trachea, along which a production of that membrane mounts on each side, and is often continued into a border at its free upper margin (*membrana semilunaris*). In the parrots this partition is wanting. On the outside of each of the bronchi is a fold of the mucous membrane projecting inwards, provided with elastic fibrous tissue, and forming a vibrating vocal ligament (*lamina glottidis*). Very various are the muscles which move this apparatus. In very many birds (gallinaceous birds, ducks, &c.) the lower larynx has no proper muscles, but the vocal ligaments are slackened by muscles which draw downwards and shorten the wind-pipe. A pair of these muscles (*musculi sterno-tracheales*) is the only part of the motor system of the wind-pipe that is constantly present. These muscles ascend from the inner surface of the superior angles of the sternum along the wind-pipe, and are inserted into it at a greater or less height. A second pair of muscles, less constant than the preceding, ascends from the furcular clavicle to the wind-

[1] This is wanting in only a few birds, as the stork, the struthious birds and the genus *Cathartes* ILLIG.

[2] *Archiv*, 1842, s. 7, Tab. I. fig. ult.

pipe. In addition to these most birds have some proper muscles of the inferior *larynx* which draw one or more rings (the second and third) of the *bronchi* upwards, running from the lower part of the trachea to these rings or to the membranous space on the outside of the base of the *bronchi*. In many songsters of the old world five or six pairs of these muscles have been distinguished; and hence this complex system of muscles (for singing) has been incorrectly ascribed to all the Passerines, which however in very many American, especially South-American genera, is not present[1]. The sound produced in the inferior *larynx* is conducted, and also in some degree modified, by the wind-pipe and the superior larynx. The wind-pipe of birds consists of perfectly closed cartilaginous, or in very many genera bony rings, which are connected by membranous, mostly small, interspaces. It is, in accordance with the neck, of remarkable length, and forms in some waders, swimmers and a few gallinaceous birds special curvatures, mostly included in the sternum, principally (or sometimes solely) in male individuals, yet also equally developed in both sexes, as in the wild swan (*Anas cygnus* L. or *Cygnus musicus*). In some male birds the wind-pipe has nearly mid-way an oval flat expansion (*Anas clangula, Anas fusca*, &c.); sometimes two such expansions lie one behind the other (*Mergus merganser*)[2]. Birds, whose voice has a very extensive musical scale, are able to shorten and lengthen their wind-pipe considerably, and, to that end, have very thin rings and larger membranous interspaces. The inferior rings of the wind-pipe above the *bronchi* are usually nearer together, or are connected by longitudinal processes, or even, as in many songsters, have wholly coalesced to form a continuous bony cylinder. We may also remark, that in

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[1] Compare CUVIER *Magasin encyclopédique*, Tome II. No. 7, p. 330, suiv., and translated (*über den untern Larynx der Vögel*) in REIL'S *Archiv*, V. s. 67—91, and *Leçons d'Anat. comp.* IV. pp. 450—491, sec. édit. VIII. 730—772; SAVART *Mémoire sur la voix des Oiseaux, Ann. de Chemie et de Physique*, 1826, *Mai et Juin;* and J. MUELLER *Ueber die bisher unbekannten typischen Verschiedenheiten der Stimm-Organe der Passerinen, Abhandlungen der Akad. d. Wissensch. zu Berlin, Physik. Mathem. Klasse*, 1845, s. 321—391, Tab. I.—VI.

[2] Compare YARRELL *Observations on the Tracheæ of Birds, Linn. Transact.* XV. 1827, pp. 378—391, with many figures. In no bird perhaps is the *trachea* comparatively longer than in *Anas semipalmata* LATH., where it makes four curvatures before dividing into the *bronchi;* see Pl. 13.

many species of ducks, and in the genus *Mergus*, in the males, there are lateral expansions at the origin of the bronchi, which are developed unsymmetrically, so that the swelling on the left side is usually the larger. In the ducks they are usually bony vesicles, in *Mergus* large many-sided spaces, with bony margins, between which a stout membrane is stretched[1]. The superior larynx is situated under the base of the tongue. It consists of ossified cartilages, of which the largest is high in front and triangular, low behind, annular and not completely closed, and corresponds to the thyroïd cartilage of man. The posterior part of the ring is formed by a small cartilage, the cricoïd, which projects beyond the ring upwards. On each side of this projecting portion lies a triangular elongated part; between these two (*arytænoïd cartilages*), which are concave on their inner surface, lies the *glottis;* it presents no vocal ligaments, and can be narrowed and widened, but not stretched and slackened. The anterior and upper part of the thyroïd cartilage has sometimes an epiglottic process, which mostly remains cartilaginous; more rarely is there found here a moveable appendage as a vestige of an *epiglottis*, which, as a rule, is totally wanting in birds. Conical, horny papillæ, with their points turned backwards, generally surround the base of the tongue and the *glottis;* they prevent particles of food from falling into this fissure. Also a transverse fold of the mucous membrane is mostly found in front of the *glottis*, under which the *larynx*, which in deglutition is drawn forward, can retreat[2].

The kidneys are large, and are situated in a depression of the iliac bones; they have a dark-red colour and a soft tissue, in which no distinct cortical and medullary substance is observed. The external surface presents convolutions which resemble those of the brain of mammals. Here are found the terminations of the tortuous secretory uriniferous tubules, which are pennated on each side by blind terminal branches that run parallel to each other. In the interior of the kidney the tubules unite to form larger tubes which are collected into bundles, from which the branches take

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[1] YARRELL, l. l. Tab. 15; compare also ROSENTHAL *Abhandlungen aus dem Gebiete der Anat. Physiol. u. Pathologie*, Berlin, 1824, 8vo, s. 40—75, Tab. IV.

[2] MECKEL *Syst. d. vergl. Anat.* VI. s. 464—469, and especially HENLE *Vergleichend Anatomische Beschreibung des Kehlkopfs*, Leipzig, 1839, 4to, pp. 54—66.

their rise, which afterwards terminate in the *ureters*. The two ureters run (in the male birds in close proximity to the *vasa deferentia*) to the *cloaca*. On the absence of an urinary bladder we have already spoken; the secretion too is here a pultaceous, white mass and by no means a liquid substance as in the mammals. The arteries of the kidneys arise principally from the aorta, but in addition they derive branches from the ischiadic arteries for their middle and posterior portions. The veins of the kidneys run into the iliac veins. An afferent renal vein, which JACOBSON ascribes to birds, is not present; it is the *vena iliolumbalis*, which runs through the anterior part of the kidney, which has been taken for it[1]. The succenturiate kidneys, which lie under the anterior portion of the kidneys are of a yellow or orange colour. There seems to be some relation between them and the sexual organs (ovaries, testes), close to which they are situated; for they have been observed to be much larger in the pairing season, when the sexual organs are also swollen, than is usual at other times.

Usually only one ovary and one oviduct, that of the left side, is developed. In some of the birds of prey, and occasionally in other birds also, two ovaries have been observed, of which, however, that of the right side was much more feebly developed, whilst also a right oviduct that terminated blindly and was much smaller than the left, mostly without, in some cases however with a right ovary, has been met with[2]. Consequently the single ovary of birds does

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[1] Compare A. FERREIN *Mém. de l'Acad. des Sc.*, 1749, p. 489 and foll.; G. R. TREVIRANUS *Beobachtungen aus der Anat. u. Phys.*, 1stes Heft, Bremen, 1839, 4to, p. 127, Tab. XIX. fig. 117; MUELLER *de Glandul. secern. structura*, pp. 92—94, Tab. XIII. figs. 7, 9, 10; R. WAGNER has given a figure of a Malphigian body from *Strix Aluco, Icones Physiol.* Tab. 20, fig. 6, and BOWMAN from the parrot in his paper on the kidney, *Phil. Trans.* 1842, Pt I. Pl. IV. fig. 13.

[2] Compare, besides CUVIER and TIEDEMANN (*Zoologie*, II. s. 712—726), EMMERT in REIL'S *Archiv*, X. s. 382; G. SPANGENBERG *Disquisitio anat. circa partes genitales fœminæas avium*, cum Tab. V. æn., Gottingæ, 1813, 4to (Tab. II. fig. 4 *g*, right oviduct in a duck); GEOFFROY ST.-HILAIRE *Mém. du Mus. d'Hist. nat.*, 1823, Tom. X. pp. 57—84, Pl. IV.; R. WAGNER *Beiträge zur Anat. der Vögel*, l. l. s. 271—283; (a figure of the two ovaries in *Falco palumbarius;* in *Gypogeranus* he found a right ovary with right oviduct).

There are in the chick, as RATHKE has observed, originally two ovaries and two oviducts. Those of the right side, however, soon cease to grow at the same rate as those of the left, and are absorbed in a few weeks after the chick has left the egg.

not lie exactly in the middle, but more to the left side, on the inside of the anterior part of the kidney of that side. It is a flat organ, with transverse folds on the ventral surface in which the eggs are formed. Those eggs which are nearest the surface are most developed and thus higher coloured and larger; the vascular envelop with which they are covered forms a cup (*calyx*), which at its base extends into a pedicle, so that the ovary, when many of its eggs are becoming ripe, has a clustered appearance. In the middle of the calyces a whitish ring or girdle is seen, indicating the place where the capsule of the egg, when the development in the ovary is completed, bursts open; when the egg has escaped the cup contracts and shrinks up[1].

The egg is now received by an oblique elongated opening at the upper part of the oviduct, which is capacious and funnel-shaped (*infundibulum*). Gradually becoming narrower the long oviduct proceeds tortuously downwards; its internal surface presents longitudinal folds. In this part of the oviduct the white of egg is secreted, which is deposited in layers around the yolk. Then a wider part succeeds, in which the egg tarries longer and the calcareous shell is formed. This part, covered internally with large *villi*, is named the *uterus* by some writers; whilst the last portion which opens into the *cloaca* and transmits the egg now completely formed is named by them the *vagina*. They are not however distinct organs, but only divisions of a single tube. The bowel-shaped oviduct is supported by a fold of the peritoneum and attached to the spinal column. In some few birds only is there a *clitoris* present in the *cloaca*[2].

(*Beitr. zur Gesch. der Thierwelt*, 1825, III. s. 57, 58). The presence of two ovaries in adult birds is therefore to be regarded as the persistence of an earlier state (*Hemmungsbildung, Arrest of development*).

[1] The ovary of the fowl has been often figured, see, for instance, R. DE GRAAF *Opera omnia*, 1705, Tab. XVIII. p. 253; GEOFFROY ST.-HILAIRE *Mém. du Mus.* X. P. 4, fig. 1 M. M. CARUS *Vergl. Zootomik.* Tab. XVI. fig. 15; LEREBOULLET *Recherches sur les organes génitaux des anim. vert., Nov. Act. Acad. Cæs. Leop. Carol.* XXIII. P. 1, 1851, Pl. 3, fig. 43, Pl. 11, fig. 110, &c.

[2] In the ducks and the struthious birds; see on the last named, where this organ presents a groove on the surface like the penis, MUELLER *Ueber zwei verschiedene Typen in dem Bau der erectilen männlichen Geschlechtsorgane bei den strausartigen Vogeln. (Abhandl. der Akad. der Wissensch. zu Berlin*, 1836, *Physik. Math. Kl.*) s. 21, 22, Tab. I. figs. 3, 4.

The male birds have two testes[1] which are placed upon the anterior portion of the kidneys, on each side of the aorta and the inferior cava. Their form is oval, the colour usually white or yellowish. Commonly that of the left side is larger. During the pairing season they increase greatly in size, whilst at other times they are contracted into a small bulk[2]; in birds living in polygamy they are at all times larger than in others. A white and very vascular membrane (*tunica albuginea*) covers the tissue of the testis, which consists of many, very fine, convoluted tubules. These tubules unite to form wider tubes, *vasa efferentia;* these afterwards form the epidydimis which, scarcely distinct from the testis, lies as an oval mass upon the *tunica albuginea*, and terminates below in a point. From its extremity the very tortuous efferent vessel (*vas deferens*) arises, which passing over the kidney and afterwards along the outside of the ureter runs to the *cloaca*. In the development of the two efferent vessels that difference is not remarked which is often observed between the two testes. They become wider in their course and in many birds expand at their extremity into a vesicle (*vesicula seminalis*). The apertures of the two efferent vessels are situated externally to those of the ureters; near each of them is a small conical eminence which is highly vascular. These two conical papillæ are found in all birds; they were formerly regarded, incorrectly, as a double penis. This organ is wanting in most birds; only some possess a penis, without however on that account being destitute of the aforesaid papillæ. The penis which is met with in many waders (*Ardea, Ciconia, Otis*) and in some gallinaceous birds (*Crax, Penelope, Crypturus*), is only in a rudimentary state, of a tongue-shaped form, sometimes with, sometimes without a conspicuous groove on its upper surface. In the *Anatinæ*, in the genus *Casuarius*, and in the American Ostrich, there is a penis which on copulation is in part brought outwards by eversion, and which has on its internal surface a

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[1] Some writers appear to have met with a single testis occasionally, or even with three.

[2] ARISTOTELES *De Animal. Hist.* Lib. III. cap. 1. This wonderful change in the size of the testes from January to April has been represented by HUNTER in the common sparrow (*Fringilla domestica* L.), *Catalogue of the Physiol. Series*, &c. Vol. IV. Tab. 50, transferred by OWEN, TODD'S *Cyclop.* l. l. p. 354.

groove which then faces outwards. A yellow elastic ligament retracts this tube inwards. The part of the penis which is not everted, consists of two fibrous bodies with a groove that is surrounded by spongy tissue. Quite peculiar is the *typus* observed in the penis of the ostrich of the old world. This is large, conical, without a membranous evertible part; besides the two fibrous bodies there is here an elastic body which occupies the space or groove between those parts on the under surface, of which the tissue corresponds with that of the *ligamentum nuchæ*, and which forms also the extremity of the penis resembling a *glans*. The groove on the upper surface of the penis is covered by a spongy venous tissue. When at rest this penis is bent and concealed in a sac of the *cloaca*[1].

Here we may remark that in birds the external sexual difference is commonly much greater than in the rest of the vertebrate animals, a difference which is especially observable in the marking and colour of the feathers; usually the males are much more richly ornamented. This is most striking when the birds have attained their full size and the capacity to propagate, and is particularly observable at pairing time (in their wedding-dress).

On the development of birds in the egg, which in its chief features corresponds with that of the *Reptilia haplopnoa* (p. 225), we must not be entirely silent when reviewing their general characters. The ovarian egg consists, like that of other animals, of the yolk and the germinal vesicle with the germinal spot (see above, pp. 4, 5). Whilst still in the ovary the yolk attains its full size; it has been observed that its weight, when the egg has fallen into the funnel of the oviduct, is exactly the same as that of the yolk of an egg just laid. The white of egg, which is disposed around the yolk in the oviduct, consists of two layers; the external layer is

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[1] Of the male organs of propagation in birds those of the cock especially have been often figured; see, ex. gr. DE GRAAF, l. l. p. 231, Tab. XVII.; CARUS *Vergl. Zootom.* Tab. XVI. fig. 16, *Catalogue of the Physiol. Series in the Museum of the College of Surgeons in London*, IV. Pl. 50, fig. 1;—of *Mergus merganser* in CARUS *Tab. anat. comp. illustr.* V. Tab. 7, fig. 2. Compare also on this subject G. G. TANNENBERG *Diss. inaug. sistens spicilegium observationum circa partes genitales masculas Avium*, cum tabulis æn., Gottingæ, 1789, 4to, and J. MUELLER, in his Memoir already quoted, *Ueber zwei verschiedene Typen*, &c.

formed of a thinner fluid; the second or inner layer of albumen is present in greater quantity, is thicker, more tenacious and very clear in colour. Above and below the yolk is a tortuous filament attached to the yolk-membrane by a broad base, whiter also and firmer than the rest of the albumen (the two *chalazæ* or *grandines*). At the obtuse extremity of new-laid eggs there arises, in consequence of the separation from each other of the two laminæ of the white tough membrane which invests the inner surface of the shell, a small space. This space is caused by the evaporation of the albumen whilst the atmospheric air passes inwards through the shell; it gradually increases during the brooding[1].

The development of the young bird proceeds, as is well known, by means of brooding after the egg has been laid. The birds form the only class of vertebrate animals of which all the species are oviparous. Pathological cases, however, have occurred in which eggs that have been retained in the abdominal cavity or in the oviduct have been hatched by the warmth of the living body[2]. The warmth requisite for the development of the chick in the egg is about 100° FAHRENH. (35—40° C.); in a somewhat lower temperature the development still proceeds, though more slowly; a temperature above 44° C. causes the death of the chick. Since the eggs that lie directly under the breast of the hen are necessarily exposed to a greater heat than those placed at the edge of the nest, the hen moves the eggs after a time and places those in the middle at the edge, and conversely, so that the development of the whole proceeds contemporaneously. This development continues in the brooded egg of the hen for about twenty-one days. As it proceeds

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[1] J. C. HEHL *Diss. inaug. de natura et usu aeris ovis avium incluso*, Tubingæ, 1796, 4to, and in REIL'S *Archiv*, II. s. 496—500. Hence arises a diminution of weight in the eggs, even when not brooded; but the loss of weight is greater in brooded eggs.

The air of this cavity does not differ materially in the proportion of its gases from that of the atmosphere; at first, however, it appears to contain more carbonic acid gas. In irrespirable gases, or when precluded from the access of atmospheric air, the eggs cannot undergo development. Fresh eggs can endure great cold, before being frozen; if they have been once frozen and again thawed, or if the capacity to germinate be destroyed, as, for instance, by a powerful electric shock, then they freeze much more readily; see experiments of PAGET to this effect, *Philos. Transactions*, 1850, Part I. pp. 221—226.

[2] "*Etiam Gallina vivos fœtus peperit.*" HALLER *Elem. Physiol.* VIII. p. 46; compare also the examples of this in TIEDEMANN *Zoologie*, III. s. 145—147.

the albumen is first diminished by evaporation, by which the air-space at the obtuse end is enlarged; the yolk changed into a milk-coloured fluid becomes surrounded (on the sixth or seventh day) by the constantly growing germinal membrane and forms a yolk-sac connected with the embryo; finally (on the nineteenth or twentieth day) this yolk-sac is taken into the abdominal cavity of the embryo.

The first commencement of development consists in this, that the germ (a round disciform lamina lying immediately under the yolk-membrane) separates itself more and more from the other parts of the egg. The germ becomes firmer and more membranous; the middle becomes transparent (*area pellucida s. germinativa*), and has a darker margin; at the same time two or three concentric rings (*halones*) in the yolk appear around the germ. The clear area has first a round, then an oval form, but as early as the second day becomes elongated, round and broad at both extremities and narrow in the middle. In the germ itself two layers or laminæ are developed; the uppermost layer is the serous or animal layer, the lowest the mucous or vegetative. The serous layer consists of round or multangular flat cells, with a nucleus and small granules, placed close together; the mucous layer consists of cells without nucleus which are smaller in the clear area, whilst at the margins of this layer larger and smaller cells are intermingled with darker globules and small granules lying diffused in a formless intercellular substance[1]. Somewhat later a third layer is seen between the other two which is named the vascular layer (see above, p. 5).

As the germ separates itself from the other parts of the egg, so also a separation takes place in the germ itself; one part of it becomes the *embryo* whilst the other retains the name of germinal membrane into which the embryo passes without any determinate boundary at first. Afterwards the two layers of the germ exist in the *embryo*, and in it the dorsal part is first formed from the serous layer. The first rudiment of the chick is seen about the fourteenth or fifteenth hour of brooding as a narrow streak (*nota primitiva*) which is somewhat broader at one extremity and about 1½ line long; this streak lies in the long axis of the transparent field (*area pellucida*), which itself is situated not in the

[1] SCHWANN *Mikroskop. Untersuchungen*, s. 65–67, Tab. II. figs. 6, 7.

long direction of the egg, but lies transversely upon the yolk, and making nearly a right angle with the long axis of the egg. The primitive streak is a groove; a few hours later there appears at its two sides an ascending ridge-like dorsal lamina. These two dorsal laminæ, which gradually approach each other above and at length coalesce in the mid-plane, were named by PANDER the primitive folds (*Primitiv-falten*). In the primitive streak, and so between these dorsal laminæ, the central nervous system is formed; beneath it arises as a fine thread the notochord (*chorda dorsalis*, see above, p. 8), the first commencement and precursor of the spinal column; afterwards this chord becomes surrounded by the bodies of the vertebræ, and finally is quite suppressed by them. On each side of the *chorda dorsalis* small four-sided white plates begin to be distinguished in the dorsal laminæ, at first four or five, in front of and behind which others gradually become visible; these little plates are usually considered to be the commencement of the vertebræ[1]; the mucous lamina is loosely attached to the inferior surface (that turned towards the yolk) of this first commencement of the chick. As yet there is no abdominal cavity. The commencement of it is made, on the second day, by two parts of the animal layer situated on the outside of the dorsal laminæ, the so-named (*laminæ ventrales*), which extend superficially and bend downwards. These laminæ thus form the lateral walls of the abdominal cavity, which is slowly closed, and not completely so before the development of the chick has been completed. The cavity, on the contrary, which contains the central parts of the nervous system, the spinal marrow and the brain, is speedily inclosed. Even on the second day the dorsal laminæ meet by their margins in the mid-plane and coalesce. In front the dorsal laminæ separate farther from each other, and thus bound a larger space which incloses a clear fluid situated in vesicular spaces behind each other, from which afterwards the cerebral mass is developed. Already, on the first day, the embryo has assumed a curved direction, and the anterior extremity (originally the broader end of the *nota primitiva*) is bent more and more downwards. At the posterior extremity, on the second day also, there is a curvature, and thus the embryo lies, like an upset boat, with

[1] REMAK, on the contrary, thinks these plates may be regarded as rudiments of the cerebro-spinal nerves, MUELLER'S *Archiv*, 1843, s. 478—484.

its keel-shaped back turned upwards and its cavity towards the yolk. The vegetative layer forms the intestinal canal, which is still open below and passes into the germinal membrane. This passage becomes gradually narrower and narrower, and at last forms the umbilical aperture. On the second day also the formation of the heart begins, and the circulation of the blood is prepared for by vessels of the germinal membrane, by which the second period of the history of development is distinguished.

The second period of development commences with the third day and includes three days. The darker margin, that in the beginning surrounded the transparent area (see above, p. 350), has expanded into a larger circle (the *area vasculosa*). This area is formed by the vascular layer (p. 350) which has been developed between the animal and vegetative layers. In this space a vascular network appears in the second half of the second day. Round the area is a circular sinus or a vein (*sinus terminalis*, *vena terminalis*), from which the blood by three or four principal stems returns to the *embryo*, whilst from the embryo blood flows to the vascular area by two transverse stems of which the direction consequently makes a right angle with that of the venous stems[1]. The cloudy circles (*halones*), which as early as the second day had become less conspicuous, have now entirely disappeared.

During this period the embryo acquires an envelop formed by a prolongation of the animal layer which is turned up on each side of it and around its two extremities and thus forms two folds which gradually meet above the back and unite with each other (on the fourth day). In this way the embryo is inclosed in a vesicular membrane, the *amnion*, which is in connexion with the skin of the embryo where the walls of the trunk pass into the animal layer of the germinal membrane. This connecting part is the skin-navel. The mucous layer, in connexion with the intestine, forms the intestine-navel (*ductus vitello-intestinalis*) situated within the skin-navel. The heart has at first the form of a bent tube, which at its lower extremity receives the veins of the vascular area. The upper part of this tube (afterwards changed into the *bulbus aortæ*) gives

[1] A beautiful magnified representation of this circulation of blood has been given in a large figure by PANDER in his *Beiträge zur Entwickelungsgeschichte des Hühnchens im Ei*. Würzburg, 1817, 4to, Tab. VIII. See also WAGNER *Icon. Physiol.* (ed. prim.) Tab. IV. figs. 4, 5.

off four vascular arches on each side, and between these three fissures are formed. This disposition, which reminds us of the class of fishes, was by RATHKE, who first discovered it, actually compared with the structure in that class; hence the names of branchial fissures and branchial arches[1]. On the fourth day a fifth pair of branchial arches is formed, and the first arch ceases to convey blood; the current also in the second becomes weaker, and this arch disappears on the fifth day, when thus only three pairs of vascular arches remain. These four or three arches form on each side a short stem; the two stems unite as roots of the large artery, to form a single main stem. The large artery thus formed divides, however, again lower down into two branches, and from these the arteries proceed, which are distributed transversely over the germinal membrane. In this period also rudiments of the liver, the pancreas, the *allantois* and the lungs are formed. All these parts, according to VON BAER, are merely excrescences from the intestinal canal, of which the mucous membrane penetrates the vascular layer and thus forms these parts as conical, hollow appendages. On each side of the inferior surface of the spinal column the vascular layer forms a lamina, whilst the mucous layer expands downwards; from the coalescence of these two laminæ the mesentery arises. In this period also the Wolffian bodies or primordial kidneys arise, which are situated on each side of the back along the greatest part of the trunk, consisting of many tortuous, transverse, blind tubes and having an excretory duct which opens into the *cloaca*[2]. The first rudiments of limbs are seen, on the fourth day, as small excrescences on the ventral laminæ; on the fifth day they are larger; at that time they end in a flat and round part which is attached to a narrow pedicle.

The circulation of blood through the *allantois*, which may be regarded as a respiratory organ, supersedes more and more after the sixth day the circulation through the *vasa omphalo-meseraica*, and characterises the last period, that, namely, from the sixth day to the end of brooding. The *allantois*, of which the

[1] REICHERT names them visceral arches. See his *Dissertatio de Embryonum arcubus sic dictis branchialibus*, Berolini, 1836, 4to.

[2] Compare on these parts, amongst others, RATHKE *Beitr. zur Gesch. der Thierwelt*, III. 1825, s. 50 f. f.; J. MUELLER *Bildungsgesch. der Genitalien*, Düsseldorf, 1830, 4to, s. 21 f. f. &c.

first rudiment appears on the third day as a vesicular eversion from the posterior extremity of the intestinal canal, becomes highly vascular, rapidly increases in circumference, penetrates externally between the intestine-navel and the amnion, and grows over the embryo and the amnion. About the ninth day the *vena terminalis* disappears from the vascular area; at a later period its blood-vessels also diminish and disappear. Towards the fourteenth or fifteenth day the *allantois* coalesces with itself and surrounds the entire egg, being situated immediately under the membrane of the shell; it may now be compared with the external membrane of the mammalian *ovum*, the *chorion*. The development of the chick still proceeds. From the heart two pairs of vascular arches now arise; the posterior pair already sends many branches to the lungs, and is afterwards changed into the pulmonary artery; the two anterior and an unpaired arch on the right side, between the anterior and the posterior arch, are the principal branches of the great artery present in the full-grown bird, namely the two anterior arteries and the descending artery (see above, p. 338). The permanent kidneys and the sexual organs are developed. The skeleton becomes more and more complete in all its parts, and in the cartilages from which it is formed many ossific points are now visible. The limbs which at an earlier period were uniform, now gradually assume the appearance which afterwards distinguishes them, the anterior that of wings, the posterior of legs. As early also as the eleventh or twelfth day rudiments of feathers may be observed. The yolk-sac contracts, and at last is, for the most part, received into the abdominal cavity, together with the part of the intestinal canal which is on the outside of that cavity, and with which it is in connexion by the vitelline duct. The bird, whose bill usually lies at the obtuse end of the shell, perforates on the nineteenth or twentieth day the membrane of the shell, and is able to breathe in the air-cavity under the shell, which explains the fact that the chick may be sometimes heard to chirp before it chips the shell. At last the young bird breaks the calcareous shell, for which a calcareous, conical excrescence on the point of the upper bill, which afterwards disappears without leaving a vestige, serves it as an instrument. It enlarges the aperture thus made, and continues still for some time with outstretched neck to rest and breathe in the egg. The circulation of blood in the *allantois* stops; the navel-ring closes

and presses off that membrane and a part of the yolk-sac from the abdomen, and the chick leaves the egg[1].

There now remain for consideration the organs of animal life in the class of birds. The mass of the spinal marrow is smaller than that of the brain, whilst the reverse was observed in fishes and reptiles. A narrow canal runs through its middle. Where the nerves of the wings (*plexus brachialis*) arise, the spinal marrow, which in the upper part of the neck is thin, becomes broader; a still more remarkable swelling appears in the lumbar region, where the nerves of the hind limbs arise. Here the posterior strands separate laterally from each other, and the central canal expands into a sac which is filled with a watery fluid. From this part downwards the spinal marrow becomes constantly thinner, runs through the tail, and finally terminates in a fine thread; a so-named *cauda equina* is not present[2].

The brain is more fully developed than in the two preceding classes. In the first place, its mass is larger; in general, at least, it surpasses in relative magnitude that of most reptiles, and of all fishes[3]. It entirely fills the cranial cavity. Again, the greater

[1] Amongst the numerous writings on the development of the chick we name only M. MALPIGHII *Diss. epistolica de Formatione pulli in ovo* in his *Opera omnia*, Londini, 1687, fol. II.; A. HALLER *Deux Mémoires sur la formation du cœur dans le poulet*, Lausanne, 1758; G. F. WOLFF *Theoria generationis*, Halæ, 1759, 8vo (ed. sec. ibid. 1774); ejusd. *Ueber die Bildung des Darmkanals im bebrüteten Hühnchens, übersetzt von* J. F. MECKEL, Halle, 1812, 8vo; CHR. PANDER *Dissertatio inaug. sistens historiam metamorphoseos quam ovum incubatum prioribus quinque diebus subit.* Wirceburgi, 1817, 8vo (and his *Beiträge*, with 14 beautiful plates by D'ALTON, already cited above); K. E. VON BAER *Ueber Entwickelungsgeschichte der Thiere*, Königsberg, 1828, 4to, s. 1—140, and in BURDACH'S *Physiologie*, Bd. II. 2te Aufl. s. 335—446; lastly, the excellent plates of M. P. ERDL, in the first part of his work, interrupted by his death, *Die Entwickelung des Menschen und des Hühnchens*, Leipzig, 1845, 4to. We could not dwell upon the great difference of opinion of the latest writers with regard to the layers of the germ and other questions not yet sufficiently cleared up, but we have deviated only slightly from the description given in our first edition, for which the investigations of VON BAER supplied the ground-work.

[2] Compare NICOLAI in REIL'S *Archiv*, XI. s. 156—219, with a figure of the entire spinal marrow of a goose.

[3] The proportion is very various; thus the ratio between the weight of the brain and that of the whole body has been found in the sparrow as 1 : 25, in the chaffinch as 1 : 22, in the goose as 1 : 300, HALLER *Elem. Physiol.* IV. pp. 9, 10; CUV. *Lec. d'Anat. comp.* II. pp. 151, 152, 2e éd. III. pp. 79, 80. Still smaller than in the goose is the ratio in struthious birds; in the Indian Casuary as 1 : 670 or even 1 : 1000, MECKEL *Archiv für Anatomie und Physiol.* VI. 1832, s. 352.

development of the brain is obvious from the position of its several parts which are no longer situated in one plane, behind each other, as in fishes and reptiles. The broad *medulla oblongata* now makes an obtuse angle with the spinal marrow of the neck. The second cerebral mass, which in fishes and reptiles is situated in front of the *cerebellum*, and behind the hemispheres of the cerebrum (see above, p. 43), is here placed below, and on the upper surface are seen the two large hemispheres and the cerebellum alone. This last, although it has lateral appendages, still consists principally of the middle part, which in anatomy is named *vermis cerebelli*. The medulla of the cerebellum presents that peculiar branching expansion to which the name of *arbor vitæ* is given in human anatomy. The cavity of the medulla oblongata (the fourth ventricle) penetrates far into the cerebellum. On the surface of this medullary mass many transverse furrows are visible. The cerebrum exhibits no convolutions, but has an entirely smooth surface; it has capacious cavities (*ventriculi laterales*) in which large striated eminences are seen (*corpora striata*). Above and behind the anterior commissure is a thin transverse medullary lamina, which, according to the interesting discovery of A. MECKEL, connects, as a rudimental *corpus callosum*, the two hemispheres[1]. On the base of the brain no *pons Varolii* is yet visible (p. 227); in front of the medulla oblongata the under surface of the above-named second cerebral mass is seen as two lateral eminences corresponding to the *corpora quadrigemina* and hollow internally. From these the very thick optic nerves proceed forwards, form a curve and approach each other transversely to meet in front of the *infundibulum* where they split into a number of medullary laminæ, which receive one another on each side like the fingers of two clasped hands. The olfactory nerves arise from a conical swelling at the fore part of the hemispheres; white medullary fibres at the base of the hemispheres run in part to these nerves; those fibres may be followed in the other direction as far as the optic thalami. The pairs of cerebral nerves are the same in

[1] Compare especially A. MECKEL *Anatomie des Gehirns der Vögel* in J. F. MECKEL'S *Archiv für die Physiol.* II. 1816, s. 25—78, Tab. I. Many figures of the brain of birds are to be found in the first edition of WAGNER'S *Icones Physiologicæ*, Tab. 22, figs. 2, 3, 4, Tab. 23, figs. 14—17, Tab. 24, fig. 16, Tab. 25, fig. 9, Tab. 26, fig. 5, Tab. 27, fig. 13.

number as in mammals; also the principal divisions of them are the same. The facial nerve is feebly developed. The first branch of the fifth pair has a distribution which deviates from that in mammals and seems to indicate that, in part, it also corresponds to the second branch of that pair; also it is sometimes thicker than the second; the third branch gives off no lingual nerve (comp. above, p. 228). The tenth pair, that of the *nervus vagus*, seems to take the place of the *n. lingualis;* a branch from that pair joins the *glossopharyngeus*, whilst a distinct lingual branch from the *vagus* is often present in addition[1].

The upper cervical ganglion of the great sympathetic nerve lies close to the outlet, from the cranium, of the ninth and tenth pairs. From this ganglion two branches proceed to the head, which communicate with branches of the fifth, seventh and ninth pairs. The cervical portion of the great sympathetic enters the canal of the transverse processes between the first and second cervical vertebræ and issues from it again at the penultimate cervical vertebra, then runs over the brachial plexus and forms in the thoracic cavity large ganglia which are mutually connected by two nervous filaments or a double limiting cord. In the posterior part of the abdominal cavity the limiting cord again becomes single, and the nerves of the two sides approach each other more and more towards the mid-plane[2].

The sense of feeling cannot be highly developed in birds, since their body, with the exception of the beak, of the legs, and in some of certain parts of the head or the neck, is entirely covered with feathers. The anterior limbs are absolutely unable to serve for tact since they are changed into wings, the posterior too, besides their use in standing and progressing, serve only for seizing

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[1] Compare on the cerebral nerves in birds SCHLEMM *Observationes neurologicæ*, Berolini, 1834, 4to, pp. 17—20, and M. J. THUET *Disquisitiones anatomicæ Psittacorum*, Turici, 1838, 4to, pp. 30—32.

[2] Compare besides E. H. WEBER *Anat. comp. nervi sympathici*, pp. 24—38, also BISCHOFF *Comment. de Nervi accessorii Willisii Anatomia et Physiologia*, Darmstadii, 1832, 4to, pp. 41, 42. In the mesentery of birds there is an unpaired nervous cord which proceeds from the *rectum*, where it is thickest, to the *duodenum* along the convolutions of the intestinal canal. At the *cloaca* is placed an elongated, large terminal ganglion; at the lowest part of the small intestine this nerve has no ganglion. See the interesting investigations of REMAK in his memoir, *Ueber ein selbständiges Darmnervensystem*, Berlin, 1847, folio.

without any provision for feeling being observable. In some birds the bill may serve as an organ of touch, as in the ducks, where the skin that covers it is thin and soft and has many branches of the fifth pair of nerves distributed to it.

We may here touch upon the feathers of birds, a covering of the skin which is peculiar to this class, and to which the body of these animals is indebted not only for the ornament of beautiful colours but also for the graceful rotundity of form by which it is distinguished. The feathers have, at their inferior extremity, a shorter or longer horny tube, the quill (*scapus*, *calamus*), by which they are attached to the skin. In the part which extends onwards towards the point, named the shaft (*rachis*) there is on the outer surface, which is smooth and somewhat convex, a lamina that is produced from the horny basal piece, and extends to the extremity of the feather, becoming gradually narrower. On the inner surface the shaft has a longitudinal groove. The shaft consists of a white spongy substance, resembling the pith of an elder-branch, which arises in the tube of the shaft by two or three roots. The quill, again, is not entirely hollow but contains some membranous parts or partitions (the so-named *pith of the feather*), which are fixed to the lower and the upper ends of the quill when the pith of the shaft begins to be formed, and are received within one another like funnels. From the shaft proceed obliquely on each side towards the point of the feather branches (*rami* NITZSCH, *radii* or *barbæ* of other writers). This branch-like part of the feather is named *flag* (*vexillum*) or *vane*. The horny laminæ of which it is composed are also provided on each side with finer rays (*radii* NITZSCH, *barbulæ*) scarcely visible by the naked eye; the anterior row of these rays, *i.e.* that which is turned towards the point of the shaft, supports minute microscopic hairs, which, in part, are bent into hooks at their extremity and cross the posterior rays of the branch immediately preceding. It is by these hooklets that the branches of the vane, especially in the flag- and tail-feathers so completely interlock; when the attempt is made to separate them, they seem to stick together[1]. In the feathers of very many birds there issues

[1] A good figure of this arrangement may be found in HOOKE *Micrographia*, Tab. 23, fig. 2; the figure of PERRAULT, on the contrary, given by OWEN in TODD'S *Cyclop.* I. p. 350, does not correspond with nature.

from a little pit or umbilical depression, at the commencement of the groove on the internal surface of the shaft, an *accessory plume* (*pluma accessoria*, *hyporrachis* NITZSCH), which in the casuary equals the primary shaft in size, but usually is much smaller than it, but is similarly formed. In the flag-feathers of the wings and the tail-feathers this part is never met with. By the quill the feathers are fixed in a tube formed by a duplicature of the skin.

If the feathers be plucked from a living bird new ones come in their place, and this reproduction occurs also annually at the so-named moult. At the bottom of the canal in which the feathers were fastened, a formative fluid is then secreted anew, which gradually accumulates and is included in a vesicle open below. This vesicle quickly assumes the form of an elongated cone of which the base is turned downwards; it afterwards perforates the skin as a horny case or sheath, and finally at its point gives passage to the vane of the new feather developed within the case. In proportion as the development of the feather proceeds, the horny case is resolved into small scales and plates and partly falls off by shaking of the feathers, or is removed by the bird when it dresses its feathers with its bill. Some downy feathers, of which the shaft is not fully formed but always remains incomplete, secrete on that account a substance or powder which falls from this horny case; feathers of this kind have been long known in the herons, where they occur behind on the back, but they are found also in other birds, in some parrots, for instance, and birds of prey.

Consequently it is the point of the feather that is first seen. The flag also is the part most early formed in the above-named sheath. Afterwards comes the quill, which at first forms a ring at the base of this sheath, but is afterwards elongated. Lastly the shaft is produced, which at first consists of two lateral parts, which soon coalesce at the horny plate of the anterior side, but remain longer distinct behind, from whence also the longitudinal groove arises which we have noticed on the posterior surface of the shaft. Finally, the membranes that fill the quill are the remnants of the fluid in which the feather was formed and which has gradually dried up in that closed space[1].

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[1] On the mode in which feathers are produced various observations have been published. In our compressed description we have principally made use of A. MECKEL

As in mammals, before changing the milk-teeth, the rudiments of the permanent teeth are present, so on the moulting of birds there already exists in the base of the dermal cell a vesicle under the old feather, from which subsequently the new feather proceeds. As in the annual decadence of the horns in stags, so also in that of the feathers, the occurrence is in close connexion with the sexual function. In like manner as castrated stags no longer shed their horns, so birds moult no more almost, when they have been rendered incapable of propagating. The relation between the sexual function and the feathers is moreover clearly indicated by the well-known difference of plumage in the different sexes, whilst finally, certain female birds, which from age have ceased to lay eggs, sometimes assume a clothing, which resembles that of the males of their species, as, for example, has been observed in pheasants and ducks[1].

The moulting of birds usually occurs about the beginning of autumn, when the brooding time has passed; many birds, those, namely, which have a winter dress, change their feathers twice a year, casting their winter dress in spring before the time of pairing.

The feathers may be distinguished as contour-feathers (*pennæ*) and as down-feathers (*plumulæ*). The first are furnished with a perfect quill and with firm branches and rays. The down-feathers have an imperfect, short quill, and the rays, destitute of little hairs or hooks, exhibit under the microscope darker knotty swellings, remote from each other, and causing them to appear as though divided into long joints. There are feathers, which, from the entire absence or slight development of the vane, almost resemble hairs, and which are distinguished as a third kind under the name of thread-feathers (*filoplumæ*). The quill-feathers are mostly placed in certain definite regions (*pterylæ* NITZSCH), between which other fields (*apteria*) are situated, which are covered with down-feathers only, or are

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Ueber die Federbildung, REIL'S *Archiv f. d. Physiol.* XII. s. 37—96, with figures. Compare also F. CUVIER *Mém. du Mus.* XIII. pp. 327—368. (REGLAM *De plumarum pennarumque evolutione*, Acc. Tab. III. Lipsiæ, 1846, and G. SCHRENK *De formatione pennæ*, Dorpati, 1848, are known to me only from REICHERT'S *Jahresbericht* in MUELLER'S *Archiv*, 1847, s. 29, and 1849, s. 21.)

[1] BLUMENBACH *Institutiones physiol.*, p. 508 (ed. 1798); ISID. GEOFFR. SAINT-HILAIRE *Mém. du Mus. d'Hist. nat.* XII. pp. 220—231, and *Essais de Zoologie générale*, Paris, 1841, pp. 493—514, Pl. 4, 5.

quite naked, however they be protected by the vanes of the neighbouring quill-feathers. The various disposition of these feathered regions has been carefully investigated by NITZSCH in different genera of birds, and has been employed as an aid in classification[1]. The quill-feathers of the wings and of the tail bear different names. The large quill-feathers, which are inserted in a row on the outside along the posterior margin of the hand and the fore-arm, are named *flag-feathers* (*remiges*). Ten or nine (sometimes eleven) of these are inserted on the hand from the point of the wing as far as the joint (*remiges primores s. remiges primi ordinis*); to them succeed the so-named *secondary flag-feathers* (*remiges secundi ordinis*), which are subject to a much greater variety of number and are attached to the ulna. The *thumb-wing* (*alula, ala spuria*) is a bundle of small stiff feathers inserted externally on the thumb. Sometimes there is a carpal tubercle above the thumb, covered with a conical horny investment. The wings are in that case said to be *spurred* (*alæ calcaratæ*), as in *Parra jacana* L., *Palamedea*, &c. The great quill-feathers of the tail are named *rudder-feathers* (*rectrices*)[2]. The large quill-feathers of the wings and the tail are covered by smaller feathers (*coverts, tectrices*; the tail-coverts are named *calypteria*).

Cutaneous glands or sebaceous and sweat glands, which in mammals are commonly present in great numbers, and are diffused over most parts of the body, are wanting in birds, with the exception of a gland situated under the skin, on the tail-bone, which, however, in some is absent. It consists of two lobes, formed of blind, parallel tubes, and secretes a white or yellow oily substance, which the birds press from the excretory ducts with their bill and with which they smear their feathers. These glands are more developed in some water-birds (especially in *Sula, Sterna, Procellaria*) than in the rest[3].

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[1] C. L. NITZSCH *System der Pterylographie*, Mit x Kupfertafeln, Halle, 1840, 4to. In the supplements also by the Editor, Prof. BURMEISTER, contributions to the history of the development of feathers are to be found, which may be compared with what has been stated above.

[2] In the description of birds these feathers are counted from without inwards, so that each of the outermost feathers is named the first, those that succeed to them the second, &c. up to the middlemost.

[3] Compare SCHNEIDER *Abhandlungen zur Aufklärung der Zoologie u. Handlungsgeschichte*, 1784, s. 158, 159, 333, TIEDEMANN *Zoologie*, II. s. 135—137, NITZSCH *Pterylographie*, s. 54—59.

From this interweaving of the description of the skin and feathers of birds we turn to the consideration of their organs of sense. Taste is little developed in birds, and in most of the species the tongue itself is quite inadapted to serve as an instrument of this sense, being merely a horny covering of the two cartilages or bones which lie side by side, or have coalesced, and which are attached to the body of the tongue-bone in front (*ossa lingualia s. entoglossa*). In the parrots however the tongue is thick and muscular, and beset with some papillæ at its base. It is muscular also in many water-birds, as the ducks, where it is provided at the margin with stiff bristle-like denticles, armed with rows of hard laminæ, and covered at the base with long soft papillæ, in front of which is a large grooved tubercle. In most birds the tongue serves merely for deglutition, or for seizing the food, as in the woodpeckers, where it can be extended far from the mouth. The tongue-bone consists, in addition to the cartilaginous or bony nucleus of the tongue itself, which has been noted, of a body mostly elongate, to which, at the back part, a stiliform bone is usually attached (*urohyale* of GEOFFROY), and of two long horns, which are sometimes cartilaginous at the apex, and mostly formed of two joints. In the woodpeckers and humming birds these horns mount upwards upon the cranium and glide downwards when the tongue is extended. The tongue of birds admits of great motion as a whole from many extraneous muscles, as extension and retraction; but it possesses little flexibility, and thus is not in a condition to bring its surface into that variety of contact with the food which is required for tasting.

The organ of smell is more highly developed[1]. On the back of the bill, at a greater or less distance from its point, mostly more towards its base, are seen the two nostrils[2]. Frequently these apertures, in order that they may not be obstructed by sand or other matters, are covered by bristles (stiff, imperfect feathers), especially in those birds which pick their food from the ground. The cartilaginous septum of the nasal cavities, that rests upon the vomer, is perforated in some birds (*nares perviæ*). The nasal

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[1] SCARPA *De Auditu et Olfactu*, pp. 77—85, Tab. III.; compare also HARWOOD *System of Comp. Anat. and Phys.* Cambridge, 1796; 4to, p. 25.

[2] In *Sula alba*, according to NITZSCH, they are entirely wanting, *Jahresbericht der Naturf. Gesellsch. zu Halle*, 1825, s. 23. SCHLEGEL, however, found them in this bird, but they cannot be perceived in *Sula piscatrix* and *parva*. *Tijdschr. voor natuurl. Geschied. en Physiol.* II. 1839, s. 168—172.

cavities are spacious and open behind by a fissure in the palate. Frontal sinuses are not present in birds. Within the nasal cavity on each side are found three laminæ, usually cartilaginous, sometimes bony; of these the middle one has more or fewer spiral convolutions, the lowest is always very small. These laminæ correspond to the *conchæ* or spongy bones (*ossa turbinata*) of mammals; they are covered by a velvetty mucous membrane. The olfactory nerves penetrate the nasal cavities undivided, without first passing through a cribriform plate (peculiar to mammals). They divide in the cavity into many fine branches, which spread themselves over the septum and upon the upper conch, which especially is the seat of the sense of smell, and of which the size appears to increase with the fineness of this. The inferior conch receives its nerves from the first branch of the fifth pair alone. According to the anatomical investigations and experiments of SCARPA on birds, the waders would seem to have the finest smell, and then the water-birds, the birds of prey, and the climbers, whilst this sense is dullest in the singing and the gallinaceous birds. Also, according to this great anatomist, the males are somewhat more acute in smelling than the females. To the olfactory organ a pair of glands also belongs, which JACOBSON and NITZSCH have brought into fuller notice. Not in water-birds only, but nearly in all birds there is found on the frontal bone, or above the margin of the orbit, or within it, a gland on each side, of which the excretory duct runs to the cavity of the nose. The fluid which it secretes is watery, and seems to resemble that of the tears[1].

The organ of sight is highly developed. In this class no examples are met with of species which have eyes either small or covered by the skin, and thus unfit for seeing, as is the case in certain species of the other classes of vertebrate animals. On the contrary, the eyes in birds are large, especially in the birds of prey. With the exception of the nocturnal birds of prey, where they are directed forward, they are placed laterally, above the angle of the bill, or more towards the back part of the head on each side, as in the snipes. The eye-ball before and behind is circumscribed by a spherical segment, but the anterior segment belongs to a smaller

[1] JACOBSON *Bulletin de la Soc. philomatique*, Avril, 1813; C. L. NITZSCH in MECKEL'S *Archiv für die Physiol.* VI. 1820, s. 234—269.

sphere, and hence the curvature of the cornea is much greater than that of the sclerotic coat in the base of the eye. When the posterior segment is large the two segments are united by a narrow margin running obliquely forward; if, on the contrary, the posterior segment be only a small portion of a sphere, then this uniting margin is elongated to form a truncated cone, and the axis of the eye becomes much longer, as, for instance, in the owls. At this part the sclerotic coat receives between its laminæ a ring of bony plates or scales, of which the number differs in different birds, but is commonly fourteen or fifteen[1]. Fibres of striped muscle proceed forward from these scales and are inserted into the inner lamina of the cornea[2]. Their action will increase the convexity of the cornea. The vascular membrane (*choroïdea*) is covered abundantly with a black pigment. As an arrangement in the eye peculiar to birds the black fan or *comb* (*pecten*) must be noticed, which consists of a fold of the vascular membrane (*choroïdea*), and may be regarded as a higher development of the sickle-shaped band in the fish's eye (see above, p. 48), and of the fold present in many lacertine animals (see above, p. 232). This fan proceeds from the entrance of the optic nerve into the eye-ball obliquely upwards to the axis of the eye, and in many extends as far as the capsule of the lens. The number of the folds is various; they are most numerous in the *Passeres*, from twenty to thirty; on the other hand they are fewest in number in the nocturnal birds of prey and *Caprimulgus* (five to seven)[3]. This part does not contain muscular tissue, and hence the only effect it can produce by changing its circumference must be caused by the greater or less distension of the blood-vessels which are very numerous in it. On the probable use of the fan many surmises have been formed; we here notice only the opinion

[1] A full description of this bony ring has been given by J. A. ALBERS *Beiträge zur Anatomie u. Physiologie der Thiere*, 1stes Heft, Bremen, 1802, 4to, s. 73—106, with figures. In many birds there is also another ossification in the sclerotica, a bony plate in form of a ring or horse-shoe, at the entrance of the optic nerve into the bulb. See GEMMINGER *Zeitschr. f. wissensch. Zool.* IV. 1853, p. 215; F. LEYDIG, MUELLER'S *Archiv*, 1855, pp. 40—46, Taf. VI. figs. 1—7.

[2] These fibres form the *musculus cramptonianus*, so named after CRAMPTON, its discoverer. THOMPSON'S *Annals of Philosophy*, 1813, p. 172.

[3] Compare WAGNER *Beitr. zur Anat. der Vögel.* (l. l.) s. 295—300. In *Apteryx* this part is wanting, according to OWEN *Zool. Transact.* II. p. 293; this is a single exception. See also on the *pecten* ÆM. HUSCHKE *Commentatio de Pectinis in oculo Avium potestate anatomica et physiologica.* Accedit Tab. æn. Jenæ, 1827, 4to.

formerly advanced by PETIT and afterwards urged by TREVIRANUS, that the *pecten*, by absorbing the rays of light that enter the eye obliquely, limits the power of seeing objects that are out of the direction of the axis of the ball, and renders vision in that direction more definite and sharp. The *ligamentum ciliare*, which in the mammals contains unstriped muscular fibres, here contains striped muscular fibres; between its two laminæ is an open space (*canalis Fontanæ*); the iris possesses a high contractility, and presents muscular fibres which run round the pupil in concentric circular bundles, and lie under the external layer of pigment upon which the different colour of the iris (commonly yellow or brownish) depends. The pupil is usually round. The lens is commonly more convex in proportion as the cornea is more flat, as in swimming birds; it is, however, on the whole, much less convex than in fishes and reptiles, and is placed far from the convex cornea, so that the anterior chamber of the eye is spacious, and the quantity of the aqueous humour considerable. The bird's eye is distinguished from that of mammals not only by the *pecten* but also by the disposition and course of the ciliary nerves; these in mammals penetrate the eye-ball and iris on every side, in birds, on the contrary, only on one side of the eye, the inferior, and afterwards divide into branches which are distributed circularly over the iris[1].

Three eye-lids are present; besides the two horizontal eye-lids, the upper and the lower, here there is always a third vertical eye-lid at the inside, the *membrana nictitans*, which is transparent and moderates the too powerful action of the light, by drawing itself like a curtain over the anterior surface of the eye-ball. In different birds, diurnal birds of prey for instance, in the toucan (*Rhamphastos*), in *Casuarius*, in *Struthio* there is found a row of black eye-lashes, or stiff, imperfect feathers along the margin of the horizontal eye-lids. The lacrymal gland is commonly small, round, and reddish, and is situated upwards at the posterior angle of the eye. Birds have, in addition, a gland called Harder's gland (see above, p. 232) on the anterior surface of the eye-ball, of which the excretory duct opens behind the *membrana nictitans*. This membrane

[1] KIESER in OKEN'S *und* KIESER'S *Beitr. zur vergl. Zoologie, Anatomie u. Physiol.* 1807, II. s. 98; see figures in TREVIRANUS *Beitr. zur Anat. u. Physiol. der Sinneswerkzeuge.* Bremen, 1828, fol. Heft 1, Tab. I. f. 12, 13.

is moved by a muscle (*musculus pyramidalis*) which arises on the posterior surface of the sclerotic under the entrance of the optic nerve and has a very long tendon which passes above the optic nerve, and is inclosed in the canal of a second broad muscle (*musc. quadratus*) on the upper and back part of the sclerotic; on leaving this canal the tendon proceeds over the eye-ball forward and downward to be inserted into the margin of the third eye-lid[1]. The eye-ball has also its six proper muscles, as in man, four straight and two oblique; they partly cover the two preceding muscles, and are short: the ball has less mobility in birds, and in them the direction of their sight to different objects is effected less by the motions of the eye than of the whole head[2].

The organ of hearing presents in birds an adherence to a general form in a much greater degree than in reptiles, where in different orders it stops at very different grades of development. In addition to the vestibule the auditory organ has in all birds a tympanic cavity, an auditory ossicle, a tympanic membrane, an Eustachian tube, and an external auditory passage. A thin bony lamina surrounds the membranous vestibule, and, since this lamina is enveloped by a cellular and loose bony tissue, the bony vestibule in birds may be easily exposed. The three semicircular canals are large. The anterior and inner is the largest; it runs from before backwards with its curvature upwards, and unites by its posterior extremity with that of the posterior canal, whose arch is turned outwards and stands vertically; the third canal lies almost at a right angle under and across the direction of these, and thus is horizontal; it has two openings into the vestibule. The vestibule is small. The cochlea has the form of an obtuse cone, which at its extremity swells into an oval tubercle. The interior of this non-convoluted cochlea is divided by a thin membrane into two cavities; the membrane is stretched between two bent cartilaginous strips connected

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[1] Here, for the purpose of keeping the tendon in its place, a small bony swelling is sometimes found on the bony eye-ring. Compare on these muscles NITZSCH *Osteogr. Beitr.* s. 80, 81, Taf. I. figs. 6, 7; see also the drawings and description of these muscles in the eye of the ostrich, in *Catalogue of the Physiol. Series in the Museum of the College of Surgeons*, III. pp. 206—208, Pl. 42, figs. 4—7.

[2] Compare on the eye of birds KIESER *Ueber die Metamorphose des Auges des bebrüteten Hühnchens*, l. l. s. 89—108, W. D. SŒMMERRING *De oculor. sectione horizontali*, pp. 47—55, &c.

with each other at their extremity, and forming an elongated oval ring. There is a fenestra of the cochlea and a fenestra of the vestibule; the last, or *fenestra ovalis*, is the superior and larger; close below it lies the *fenestra* of the cochlea, which has also an oval form, and so the name *fenestra rotunda* is scarcely applicable to it. The *ossiculum auditus* is stiliform, and terminates in an oval or triangular plate, by which it rests upon the fenestra of the vestibule. The apertures of the Eustachian tubes lie close together in the palate behind the internal openings of the nasal cavities. The membrane of the tympanum has its external surface convex. The external meatus is short; its opening is surrounded by a circlet of feathers sometimes of a peculiar form, which in certain birds are elongated and extend beyond the other feathers of the head. In the owls there is a cavity in front of the external meatus furnished with various folds of skin, which in some degree corresponds to an external ear[1].

The muscles in this class are arranged in a way corresponding to the peculiar mode of life in birds. The cutaneous muscles are strongly developed, which are divided into numerous distinct parcels, and do not form such a continuous layer (*panniculus carnosus*) as is present in mammals.

The quills or stiffer feathers on the surface of the body have proper small muscles, produced from the cutaneous muscular layer, for each feather four or sometimes five in number, so that the whole number may be reckoned at more than 12,000[2]. The other muscles

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[1] See on the auditory organ of birds SCARPA *De Auditu et Olfactu*, pp. 32—36, TREVIRANUS *Ueber den innern Bau der Schnecke des Ohrs der Vögel, Zeitschr. f. Physiol.* I. s. 188—196, Tab. IX.; WINDISCHMANN *De penitiori in Amphib. structura*, pp. 28—36 (with which again compare TREVIRANUS *Die Erscheinungen u. Gesetze des organ. Lebens*, 1832, II. s. 119, 120); BRESCHET *Rech. anat. et physiol. sur l'Organe de l'ouie dans les Oiseaux, Ann. des Sc. nat.*, 2e Série, Tom. V. *Zoologie*, pp. 5—52, Pl. I. II.

[2] NITZSCH, quoted by CARUS *Veryl. Zoot.* I. s. 294. Some cutaneous muscles compress the air-sacs situated under the skin; they have been described by OWEN in *Sula alba, Proceedings of the Zool. Soc.* Part I. 1830, 1831, p. 91. OWEN has described also, at length, the cutaneous muscles in *Apteryx*, where they are more than commonly developed; this is connected with the peculiar thickness of the skin and probably also with the habit of this bird to roll itself on the ground, when it has its use in shaking the loose earth from the feathers. *Proceedings of the Zool. Soc.* X. 1842, pp. 22—24.

present an accumulation of the fleshy mass as close as possible to the trunk, a disposition by which the muscles of the limbs have short bellies with long tendons, which, especially in the legs, have a great inclination to ossify. The great pectoral muscle is remarkably developed, surpassing in most birds all the other muscles collectively in mass; yet in the struthious birds it is small. This muscle draws the humerus downwards, and thus is the principal moving power in flying. The muscles that raise the arm-bone are less developed, as the deltoïd, which is usually described as represented by three muscles, two of which however (*m. deltoideus medius* and *inferior*) are regarded by RETZIUS as muscles of the scapula (*musculus supraspinatus* and *m. infraspinatus*). The proper *musc. deltoideus* arises from the *ossiculum humero-scapulare* and by a second head, more downward and backward, from the anterior extremity of the scapula; it is attached to the crest of the humerus[1]. Peculiar to birds are the muscles with long tendons which stretch the dermal fold, provided with elastic fibrous tissue, of the wings; for the uppermost fold, between the upper-arm bone and the fore-arm, two of these are seen; for the posterior fold, between the upper-arm bone and the trunk, only one such tensor-muscle is present. The abdominal muscles are thin and feeble; the *rectus abdominis* has no transverse *inscriptiones tendineæ*. Muscles corresponding to the *psoas* and *iliacus internus* are usually not found in birds. The muscles of the neck, in correspondence with its great mobility, are strongly developed. The midriff is not indeed wanting in birds, as was generally received formerly, but still differs greatly in them, with the exception of *Apteryx*, from that in the mammal, being for the most part aponeurotic and confined to the ventral surface of the lungs[2].

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[1] On the homology of the muscles of the anterior limbs in birds RETZIUS has published some conclusions, in which amongst others he asserts that the so-named *m. subclavius* does not correspond to the similarly named muscle of mammals, but ought rather to be named *costo-coracoideus* or *pectoralis minor*. The muscle regarded as *pectoralis minor* is rather the homologue of the *m. subclavius*. See *Förhandlingar vid de Skandinaviske Naturforskarnes Möte i Stockholm*, 1842, pp. 659—664 (an extract in MUELLER'S *Archiv*, 1844, s. 15).

[2] Compare on the muscles of birds, besides the general works of CUVIER, TIEDEMANN, MECKEL, &c., HEUSINGER in MECKEL'S *Archiv f. d. Physiol.* VII. s. 182—197, Taf. 3; SCHOEPSS, *Beschreibung der Flügelmuskeln der Vögel* in MECKEL'S *Archiv f. Anat. u. Physiol.* 1829, ss. 72—176; E. D'ALTON *De Strigum musculis commentatio*. Halæ, 1837, 4to.

The station of birds, the support of their body by the hind limbs, is favoured by the flexures of the joints, by the thigh-bone bent forwards, and the *tarsus* also directed forward, as also by the long toes standing far apart. The flexure of the toes in grasping branches is effected in many birds, involuntarily and even during sleep, by the weight of the body, which bends the knee-joint. A muscle, which runs from the pubic bone along the inside of the thigh-bone (*musculus gracilis* s. *rectus internus*), goes with its long thin tendon over the knee-joint outwards, and is attached to the upper extremity of the *perforating flexor of the toes*. The running of birds is in many small singing birds rather a hopping; in the struthious birds their rapid course is assisted by the stroke of their wings. Some birds are peculiarly adapted for swimming, others for climbing; but a certain law of compensation prevails in these different motions, so that aptness in one kind is coupled with less ability in the others. The most common, the chief motion is however flying; as in swimming the feet expand their swimming-membrane, and the toes are separated from each other whilst they are extended backwards, and in the succeeding forward movement are folded together and cleave through the water with the least exposure of surface, so also in flying the wings are spread out so as to act upon a large surface of air in their down stroke, and are again folded up when rapidly brought forward. The bird flies to the right or left, in the first case by moving the left wing more, in the second the right[1]. The motion of flying is uncommonly rapid when compared with the motions of other animals. There are some birds that can fly over more than 60 feet in a second. The velocity of the swiftest race-horse is only about 40 feet in a second, and if some can perform more, they are able to support such velocity only for a short time. It is related that a falcon of the French king Henry II. flew in one day from Fontainebleau to the island Malta[2].

The intelligence of birds is more highly developed than that of reptiles. Their memory is testified by their capacity of learning,

[1] Such, long ago, was the statement of BORELLI *De Motu Animalium*, Hagæ Comitum, 1743, 4to, pp. 196, 197; but BORELLI held greatly exaggerated ideas respecting the muscular power of birds, which were refuted principally by J. J. PRECHTL in his *Untersuchungen über den Flug der Vögel*, Wien, 1846, 8vo.

[2] BUFFON *Hist. nat. des Oiseaux*, I. Paris, 1770, 4to, p. 32.

especially remarkable in some species in the imitation of sounds and of songs they have heard. Admirable also is their instinct, which, as in the insect at the last period of its life, has special regard to the preservation of the species and the care of the young. The artistic manner in which some build their nest, the solicitude with which they tend it, with which they conceal it from the eye of their enemies, the skill with which they contrive to divert the persecutions of other animals, and of man, from the place where their nest is, all this reminds us of similar exhibitions in the insect tribes.

The ordinary abode of birds is in connexion with the disposition of their moving power; the swimming membrane of the feet, for example, in the ducks, &c. at once indicates their resort to water. Some are almost entirely restricted to abide in water, as the *Aptenodytes*, which only comes to land for the brooding of her eggs. The waders live in morasses and on the shores of rivers; whilst some are able, if they have long wings, to make their nest in trees, as the herons. The gallinaceous birds live principally on the ground; climbing birds, like the monkeys and squirrels amongst mammals, in the woods. Amongst the songsters and the birds of prey are some which fly to a great height, and live partly on the ground, partly in trees. Some birds live only on mountains. Between the covering also of the body, the peculiar arrangement of the feathers, and the usual abode of birds, a striking correspondence prevails. The thick, smooth and often shining feathers of the water-birds may afford us an example of this.

The geographic distribution of birds deserves, in fine, some notice. Towards the poles the number diminishes both of genera and species; it increases in the temperate zones, and in the torrid zone of our earth there are found, just as in the other classes of the animal kingdom and the natural families of the vegetable kingdom, the greatest richness and the most abundant variety of forms. The genera of birds, of which Europe possesses species, do not form one half of the whole number that is received for the species of birds discovered on our earth. The swimming-birds are especially numerous near the poles, and, whilst the number of their species forms scarcely $\frac{1}{17}$ of that of the entire class, in Sweden it amounts to more than $\frac{1}{8}$, in Greenland to more than $\frac{1}{2}$ of the whole number of species of birds occurring in those countries. The genera *Alca*,

Colymbus (*Eudytes*) are peculiar to the cold regions of the northern hemisphere; in the seas of the southern hemisphere, the species of the genus *Aptenodytes*, are met with as their representatives. In cold countries few land-birds, that feed on vegetable food, are found; they belong to the genera *Emberiza*, *Fringilla*, *Tetrao*. Towards the temperate regions of the northern hemisphere, with the number of vegetable species, the number also of birds, that derive their food from the vegetable kingdom, increases. The number as well of species as of genera of land-birds that never occur in high northern latitudes increases more and more. The temperate zones of the northern hemisphere have in all countries a correspondence greater in proportion to their proximity to the polar zone, so that in high latitudes different Asiatic and European species occur also in America. This is, however, the case with the swimming-birds especially. Thus, for instance, *Mergus albellus*, *Mergus serrator*, many species of ducks, *Anas boschas*, *Anas clypeata*, occur equally in North America and in Europe. Amongst the fen-birds also there is a certain uniformity, especially in some species of *Tringa*, and to a certain extent amongst the birds of prey; but amongst the singing birds the uniformity in the temperate regions disappears almost entirely, or is limited to some similar species, which former writers, less acquainted with the accurate discrimination of species, regarded as identical. The greater the proximity to the tropic the greater also is the difference of species. Here also the American genera differ more and more from those of the old world. In tropical regions the species of the temperate zone almost entirely disappear, but are often represented, however, by other species of the same genera. Under the tropics, as it appears, all[1] the species of American birds differ from those of the old world. Species of birds, which in the proper sense are dispersed over the whole world (*species cosmopolitæ*), do not exist, although there are species which are spread over the northern hemisphere from the high north to the north coast of Africa and eastwards over many countries of Asia; such are *Charadrius pluvialis*, *Strepsilas collaris*, and some others. Large genera, dispersed almost everywhere, are *Falco*, *Strix*, *Turdus*, *Corvus*, *Sturnus*, *Fringilla*, *Emberiza*, *Picus*, *Columba*, *Charadrius*,

[1] Or almost all; an exception is formed by *Anas viduata* L. from South America and the west coast of Africa.

Grus, *Ardea*, *Numenius*, *Anas*, *Larus*, *Sterna*, and some others. To the old world are proper: *Vultur* (in the strict sense), many sub-genera of the genus *Sylvia* (*Sylvia*, *Luscinia*, &c.), *Oriolus*, *Alauda*, except a few species forming the sub-genus *Otochoris*, *Yunx*, *Buceros*, *Phasianus*. Of these genera some are common to Asia, Europe and Africa; to Asia especially are proper *Pavo* and *Casuarius*, to New Guinea *Paradisea;* African genera are *Musophaga*, *Numida* and *Buphaga*. Proper to New Holland are the genera *Scythrops*, *Strepera*, *Menura*. As tropical forms, which have species in both hemispheres, we notice especially in America and Asia the numerous genus *Psittacus*, of which, however, some species are met with in the southern hemisphere and in America at higher latitudes; also *Parra*, and amongst the swimming-birds, *Phaeton*, *Rhynchops* and *Plotus*. Proper to the western hemisphere are the genera: *Cathartes* (*Sarcorhamphus*), which represents there the genus *Vultur* of the old world, *Anabates*, *Dendrocolaptes*, *Tyrannus*, *Pipra*, *Icterus* (and *Cassicus*); *Tanagra* (which here represents the genus *Fringilla*, almost proper to the old world, and in Africa so numerous in species), *Rhamphastos*, *Crotophaga*, *Penelope*, *Crax*, *Meleagris*, *Tinamus*, *Psophia* and others; also, what we here name the last, but which perhaps from its numerous sparkling and ornamented, though small species, is not the least remarkable, the genus of the Humming Birds (*Trochilus*)[1].

With the geographic distribution the *migration* of birds is closely connected; this is the name given to the journeys undertaken by many of them at stated times of the year, in order to pass the winter in warmer regions, often far remote from the countries where they make their nest[2]. There are only few birds in the temperate and cold climates which pass the whole year in the

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[1] Compare on this subject TREVIRANUS *Biologie*, II. s. 171—263, TIEDEMANN *Zoologie*, III. s. 333—468, ILLIGER *Tabellarische Uebersicht der Verbreitung der Vögel, Abhandl. der Akad. der Wiss. zu Berlin*, 1812, 1813, s. 221 u. ff., WILBRAND *und* RITGEN *Gemälde der organ. Natur*, Giessen, 1821, 8vo, ss. 89—111.

[2] See respecting it, amongst others, E. D. ECKMARCK *Migrationes Avium* in LINN. *Amœn. Acad.* IV. pp. 565—600 (extracts from CATESBY, HASSELQUIST and KLEIN), H. SCHLEGEL *Verhandeling over het trekken der Vögels, Natuurk. Verhand. van de Holl. Maatsch. der Wetensch.* 1823, XVI. 2, l. l. 129—292. Also the articles compiled from many writers, by SMELLIE *Philosophy of Nat. Hist.* Edinb. and London, 1790, I. pp. 473—492; by VIREY *Nouv. Dict. d'Hist. nat.* XX. 1818, pp. 534—547, and especially by TIEDEMANN *Zoologie*, III. s. 580—642, may be referred to.

countries where they were bred. These birds are named *permanent birds* (*aves manentes*). Such, for example, are with us and in the temperate parts of Europe, the sparrow (*Fringilla domestica*), the magpie (*Corvus pica*), &c. Others migrate from one place to another without a determinate direction, and do not remove far; they are named wandering birds (*aves erraticæ*), as the woodpeckers (*Pici*). Finally, other birds undertake, as we have said, at certain times of the year, mostly united in numerous packs, long journeys, and pass the winter in warm regions. These are properly *migratory birds* (*aves migratoriæ*), as, for instance, the stork, the cuckoo, the lark, most singing-birds, the swallows, &c. This distinction, however, applies only to particular countries, for the same species, which with us are migratory, remain in warm countries through the whole year. Hence it is in tropical countries that the largest number of permanent birds are found.

Most of our migratory birds pass the winter in northern Africa. Swallows winter in Africa, where ADANSON saw them arrive in the Senegal country in October[1]; in this wandering they cross the Mediterranean Sea as well as the Atlantic Ocean along the western coast of Europe; the idea that these birds conceal themselves during winter at the bottom of water, in holes under ground or in hollow trunks of trees, and become torpid there, does not require serious refutation at this day.

In the new world, as well as in the old, birds of passage, whose abode is in the northern hemisphere, migrate on the approach of winter towards the tropic of Cancer; those of the southern hemisphere, when winter sets in, migrate towards the tropic of Capricorn. This simple statement of the matter in its greatest generality leads of itself to the idea, that the cause of migration is to be sought in the necessity that birds of passage are under to continue always in the same mean temperature. For when in the northern hemisphere during winter the warmth decreases and the snow-line descends, birds, which at that time migrate southwards towards the tropic, stop, within certain fixed limits, where the mean temperature of winter does not differ much from the mean temperature of summer in those northern regions which they have left. So the migration of birds is in connexion with the general diminution of life in

[1] *Hist. nat. du Sénégal*, p. 67.

that half of the earth in which winter prevails; and whilst thus in one half of the year the number of living creatures from the north pole to the equator, and from the equator to the south pole increases, the stream turns northward again in the other half of the year when the southern hemisphere feels the benumbing power of winter. Here too we should consider the peculiar structure of birds, by which, being brought into closer relations with the atmosphere, they are enabled to feel its influence more than other animals, and so are in a better condition to discover changes in it by which they may direct their acts. To maintain that birds migrate from deficiency of food is, as it seems to me, to substitute a final cause for an active cause, or in other words to confound the *wherefore* with the *whereby*.

SYSTEMATIC

ARRANGEMENT OF BIRDS.

CLASS XVI.

AVES.

VERTEBRATE animals, breathing atmospheric air by means of lungs; with warm, red blood, and heart biventriculate and biauriculate; all oviparous, covered with feathers, with bill rather prominent, naked, destitute of teeth. Extremities four, the anterior changed into wings, almost always adapted for flying.

ORDER I. *Natatores.*

Feet moderate or short, placed more or less behind (averse), palmate or fisso-palmate. Entire thigh and basal portion of tibia included by the skin of the trunk.

Swimming-birds.—They have the inferior part of the tibiæ mostly covered with a horny skin, as also the tarsi and toes; legs of this kind are called stilted (*pedes vadantes*); the legs are little longer than the half of the trunk (*mediocres*), or even shorter than this half (*breves*), and are placed towards the back part of the trunk (*aversi*). The plumage is thick, and penetrated as it were with much oily fluid, and thus protected from the water. The neck is often much elongated, so that these birds by extending their head over or under the water seek for and seize their food on every side. The breast-bone is large, more or less convex, and extends over the abdomen far backwards; it is incised at the posterior margin on each side, or provided with an oval opening close to that margin. On the bony or cartilaginous cavities at the inferior extremity of the larynx in some ducks and saw-bills, we have spoken already above (p. 330).

Family I. *Brevipennes* s. *Urinatores.* Wings short, in some unfit for flying. Tail very short. Feet averse, short, with tibiæ concealed more or less within the skin of trunk. Gait difficult, erect.

Short-winged.—These birds are thickly covered with feathers, which have often a silvery glance. They can swim under water, and use their wings as fins. They live mostly on animal food; they lay their eggs on the ground or in holes. Some are quite unable to fly.

Phalanx I. *Impennes.* Wings unfit for flying, fin-shaped, minute, without quill-feathers, covered with short, imbricate plumes with flattened quill. Bill cultrate. Feet very short, with hallux small, connate with the internal part of tarsus, turned forward. Covering of tarsus reticulato-granulate. Interdigital membrane excised. Short tail formed of a fasciculus of rigid feathers. (Genus *Aptenodytes* FORST., GM., ILLIG.)

The *Penguins, les manchots.* These birds live in the seas of the southern hemisphere, on the coasts of South Africa, South America, principally at Terra del Fuego, and the solitary islands of the southern Pacific. Some species extend to New Guinea and the western coast of America nearly to the line. Their upright posture and gait give them a strange appearance, especially when at the brooding time they congregate in large flocks; see for instance the plate in COOK'S *Voyage to the Pacific Ocean,* (1776—1780). London, 1784, Atlas, Pl. 4. *View of Christmas Harbour.*

The breast-bone is deeply incised behind on each side; the scapula is large and broad and flat behind. The humerus, the ulna and the radius are very flat; the last two bones form with the first, not an acute, but rather an angle in some degree obtuse.

Aptenodytes CUV., GRAY. Bill slender, long, slightly curved at the point. Upper mandible covered with plumes as far as the nostrils; groove extending from nostrils to the point of the mandible.

Sp. *Aptenodytes patagonica* FORST., BUFF. *Pl. enl.* 975, GUÉRIN *Iconogr., Ois.* Pl. 61, fig. 1, LESSON *Ornith.* Pl. 119, fig. 2; principally in the circuit of the straits of Magellan, and not only on the Falkland Islands lying to the east, but also westward on the groups of islands extending far into the southern Pacific. It is the largest species of this family; the

head and throat are black; a yellow or orange-coloured stripe on each side of the head descend and meet in the breast under the throat, and the yellow then passes into the white of the belly. This part of the skin may be often met with amongst fur-dealers. (According to G. R. GRAY two species are united under a collective name, which he distinguishes as *Aptenodytes Pennantii* and *Aptenodytes Forsteri; Ann. of nat. Hist.* XIII. 1844, p. 315.)

Catarrhactes BRISS., *Eudyptes* VIEILL., GRAY. Bill moderate, strong, acuminate, slightly hooked at the tip. Lower mandible shorter than upper, with apex rounded. Groove from nostrils not produced to the point of mandible, but descending obliquely to its margin.

Sp. *Catarrhactes chrysocome* BRANDT, *Aptenodytes chrysocome* FORST., GMEL., BUFF. *Pl. enlum.* 984, BLUMENB. *Abbild. naturh. Gegenst.* No. 46; bill and feet red; a circlet of long, white and yellow, thin feathers round the head; Van Diemen's Land;—*Catarrhactes papuensis, Aptenodytes papua* FORSTER, SONNERAT *Voyage à la Nouv. Guinée*, Pl. 115, &c.

Spheniscus BRISS. Bill moderate, grooved at the base, straight, hooked at the tip; lower mandible truncate at the point. Nostrils open, placed in the middle of bill.

Sp. *Spheniscus demersus, Diomedea demersa* L., BUFF. *Hist. nat.* XXIV. Pl. 31, *Pl. enl.* 382, 1005, CUV. *R. Ani., éd. ill., Ois.* Pl. 90, fig. 1; on the south coast of Africa;—*Spheniscus Humboldti* MEYEN, *Reise um die Erde, Zool., Act. Acad. Leop. Carol.* Vol. XVI. *Suppl.* Tab. 31; from the coast of Peru, common in the bay of Callao; very similar to the preceding species (but larger, according to TSCHUDI *Fauna Peruana*, p. 315); this bird may be tamed, and then attaches itself to its master like a dog.

Phalanx II. *Alcinæ*. Wings acute, with flag-feathers often short, with the secondaries especially very short. Feet tridactylous, palmate, with hallux none. Tarsi reticulate, mostly covered anteriorly with a row of transverse scutella.

Alca L. (excl. species), ILLIG., CUV. Bill moderate, cultrate and compressed, a little longer than high, with sides grooved. Nostrils covered by plumes.

Sp. *Alca torda* L. (and *Alca Pica* ejusd.), BUFF. *Pl. enl.* 1003, 1004, BRISS. VI. Pl. 8, fig. 1, GUÉRIN *Iconogr., Ois.* Pl. 61, fig. 2, NAUMANN, Taf. 336; the *awk;* this bird flies rapidly, notwithstanding its short wings, but close to the surface of the water, comes along our coasts in the winter, but keeps between 62° and 72° N.L., frequents the islands of the North Sea, the coasts of Norway, Iceland, Greenland, and also the west coast of America. The awk lays only a single egg, which is dirty white with black

spots. Another, larger species, common in Greenland, is unable to fly; *Alca impennis* L., BUFFON *Pl. enl.* 367, NAUM. Taf. 337.

The French writers, following BUFFON, commonly give the name of *penguins* only to the birds of this and the following genus, although by voyagers the preceding genera of birds of the southern hemisphere are thus named. Most of the species of this entire division are coloured white on the belly, black on the back, with a small white stripe on the wings, formed by the tips of the secondary flag-feathers.

Mormon ILLIG., TEMM., *Fratercula* BRISS., GRAY, *Lunda* PALL., NAUM. Bill shorter than head, equal to forehead in height, with base higher than long, compressed, two-edged. Nostrils denuded, narrow, linear, placed at the lower margin of upper mandible.

Sp. *Mormon fratercula* TEMM., *Alca arctica* L., BUFF. *Pl. enl.* 275, CUV. *R. Ani., éd. ill., Ois.* Pl. 89, fig. 1, NAUMANN *Taf.* 335; the *parrot-diver;* in the seas of the northern regions of both hemispheres, rare on our coasts. This bird lays only a single egg, of a dirty white, and larger than a duck's egg.—*Mormon cirrata, Alca cirrata* PALL. *Spic. Zool.* v. Tab. 1. BUFF. *Pl. enl.* 761, Kamschatka, &c.

Ceratorhyncha BONAP., GRAY (*Cerorhina* previously BONAP., *Chimerina* ESCHSCH.). Bill compressed, curved. Small compressed horn above the nostrils at the base of bill. Nostrils not covered by plumules.

Sp. *Ceratorhyncha occidentalis* BONAP., *Chimerina cornuta* ESCHSCHOLTZ *Zool. Atl.* Tab. 12 (the head fig. by GRAY *Genera,* Pl. 174, fig. 2); on the west coast of N. America.

Phaleris TEMM. Bill short, small, compressed towards the tip. Nostrils not covered by plumules. Tarsi reticulate.

Sp. *Phaleris cristatella* GRAY, *Tylorhamphus cristatellus* BR., *Alca cristatella* PALL. *Spic. Zool.* v. Tab. 8; from Kamschatka and the islands along the west coast of the north of America;—*Phaleris camschatica* BRANDT, *Phaleris cristatella* TEMM. *Pl. col.* 200, &c.

Note.—Here belong sub-genera *Ombria* ESCHSCH., BR., *Tylorhamphus* BR. and *Ptychorhamphus* BR.—Comp. J. F. BRANDT *Mém. de l'Acad. impér. des Sc. de Pétersbourg,* 6ième Série, *Sc. natur.* Tom. III.

Mergulus RAY, VIEILL., BRANDT, *Artica* MOEHR., GRAY, *Cephus* CUV. Bill short, conical, arched. Nostrils basal, placed in a membranous groove. Tarsi with an anterior row of transverse scutella, not resting on their lower surface.

Sp. *Mergulus melanoleucus* RAY, BRANDT, *Alca Alle* L., BUFF. *Pl. enl.* 917; the winter plumage; the summer plumage differs by the head and neck entirely black. (See BREHM *Handb. der Naturgesch. aller Vögel Deutschlands*, 1831, Taf. 45, fig. 3, NAUMANN Tab. 334, fig. 1.) This bird lives in high northern latitudes, and also visits our shores in the cold season.

Uria BRISS. Bill compressed, moderate or short, not grooved. Nostrils covered by plumules, basal, lateral, pervious. Tarsi resting, covered with an anterior row of scutella. Interdigital membrane excised.

Brachyrhamphus BRANDT. Bill much shorter than head. Feet weaker.

Sub-genera *Apobapton* and *Synthliboramphus* BRANDT. Sp. *Uria antiqua* PALL., SCHLEG. *Faun. Japonic., Aves*, Tab. 80, GRAY *Gen.* Tab. CLXXVII.; —*Uria Temminckii* nob., *Uria Wumizusume* TEMM. (*umizusume?*) *Faun. Jap., Av.* Tab. 79, &c.

Uria BRANDT. Bill acuminate, nearly equalling head in length. Feet stronger.

Sp. *Uria Troile* LATH., *Colymbus Troile* L., *Uria lomvia* BRUNN., BUFF. *Pl. enl.* 903, NAUMANN Tab. 331; *foolish guillemot, sea-coot*, &c.

Phalanx III. *Colymbides.* Wings fitted for flying, with flag-feathers short. Tarsi compressed. Feet tetradactylous.

Colymbus LATH. (Species from gen. *Colymbus* L.), *Eudytes* ILLIG. Feet palmate. Tarsi reticulate, with hexagonal scales. Pollex short, internal, enlarged by membrane internally. Tail short. Bill moderate, straight. Nostrils oblong, lateral, placed at the base of bill, pervious.

Sp. *Colymbus glacialis* L., BUFF. *Pl. enl.* 952, LESSON *Ornith.* Pl. 110, fig. 2, NAUM. Taf. 327; head and neck black green, with a white, black-streaked collar, back and wings black with four-sided white spots; breast and belly white; the largest species; like the other species of this genus, it lives in the far north on the coasts of America, Europe and Asia;—*Colymbus arcticus* L., BUFF. *Pl. enl.* 914 (younger bird), NAUMANN Taf. 328, GRAY *Gener.* Pl. CLXXI.; *northern diver*, not unlike the preceding, but with grey head and smaller; this species visits our shores in winter. (The young bird of this species has sometimes been described as a distinct species, as has also occurred in the case of the young bird of the preceding species, which was recorded as *Colymbus immer* by GUNNER, STROEM, BRUNNICH, &c. and received by LINNÆUS into his *Systema nat.*)—*Colymbus septentrionalis* L., BUFF. *Pl. enl.* 308, NAUM. Taf. 329; on the back black, below white, with a brown-red throat. These birds feed principally on fish; they

fly little and progress by small leaps, for their feet are turned outwards, almost as in frogs; they lay two grey-brown, spotted eggs.

Podiceps LATH., RETZ., alior., *Colymbus* BRISS., ILLIG. (species from gen. *Colymbus* L.). Feet lobed. Tarsi covered with large transverse scutella, serrate posteriorly. Pollex posterior, bordered by membrane. Claws flat, depressed. Tail scarcely any. Bill in some rather longer than head, in some shorter, straight. Nostrils oblong, lateral, pervious.

Sp. *Podiceps cristatus* LATH., *Colymbus cristatus* L., BUFF. *Pl. enl.* 400, NAUM. Taf. 242, LESS. *Ornith.* Tab. 110, fig. 1 (named *Col. cornuti*) the *great crested grebe;* in lakes, fish-ponds, &c.; very common in Holland;—*Podiceps auritus* LATH., STURM *Deutsch. Faun., Vögel,* 1 Heft, NAUMANN, Taf. 246;—*Podiceps arcticus* BOIE, *Colymbus auritus* L., NAUM. Taf. 245; —*Podiceps minor* LATH., BUFF. *Pl. enl.* 905, NAUM. Taf. 247, &c. These birds live on fishes, water-insects, &c., also on vegetable food. They all reside in fresh water during the brooding time, make a large nest of rushes amongst the reeds, and lay three or four dirty-white eggs. Species are found in all quarters of the world, especially however in temperate regions.

Podilymbus LESS. (*Sylbeocyclus* BONAP.). Bill short, compressed, hooked at the tip.

Sp. *Podiceps carolinensis* LATH., *Colymbus podiceps* L., BUFF. *Pl. enl.* 943; —*Pod. brevirostris, Podilymbus brevirostris* GRAY, *Gen.* Tab. CLXXII. (Species American.)

Family II. *Anatinæ* (*Lamelloso-dentati*). Bill moderate, or longer than head, straight, rather thick, covered with skin, only at the middle of tip harder, horny, with margin denticulate or furnished with transverse, parallel, crowded lamellæ. Wings fitted for flying, with flag-feathers elongate, the second primary equalling the first, or somewhat surpassing it in length. Feet palmate, tetradactylous, with pollex apart.

Duck-tribe.—A numerous and very natural family, of which more than 150 species are known, which with LINNÆUS form two genera, of which the genus *Anas* is the largest. The eggs of these birds are spotless, seldom coloured (as in *Anas spectabilis,* blue-green), but generally white or dirty white. The flesh of most of the species of the genus *Anas* has an agreeable taste; many are useful moreover from their feathers. With the gallinaceous birds they form principally the feathered animals of the cottage and the country-seat.

Mergus L. Bill subulate, hooked at the tip, with margins denticulato-serrate. Hallux enlarged by a lateral membrane.

Saw-bills, Divers.—These birds swim rapidly and dive often under water; " they fly also very well, but walk with difficulty and with a waddling gait. They feed chiefly on fish. A genus not very numerous, of which most of the species live in the high north and in winter visit temperate regions as birds of passage.

Sp. *Mergus merganser* L., BUFF. *Pl. enl.* 951, NAUM. Taf. 326, the *great saw-bill, goosander, le harle, der grosse Säger;—Mergus serrator* L., BUFF. *Pl. enl.* 207, LESS. *Ornith.* Pl. 118, fig. 2. In these two species the bill and legs are red; they are lead-coloured, and the bill much shorter in a small species which is a rarer visitor on the Dutch coast, *Mergus albellus* L., BUFF. *Pl. enl.* 449, 450, NAUM. Taf. 324, *the smew, het nonnetje, la piette, die weisse Nonne, der kleine Säger.* (From this species SELBY has formed the sub-genus *Mergellus.*)

Fulix SUNDEV., *Hydrobates* TEMM. Bill with margins lamellosodentate internally. Hallux furnished with a lax rudiment of membrane. Tarsi short, scutellate anteriorly, posteriorly and at the sides reticulate with hexagonal scales.

Note.—Here belong many sub-genera, on which compare GRAY *Genera of Birds,* pp. 620—625. Also on this and the following genera may be compared T. C. EYTON, *A Monograph of the Anatidæ or Duck-tribe.* London, 1838, 4to.

Sub-genus: *Merganetta* GOULD, GRAY, *Raphisterus* GAY. Bill short, conical. Wings spurred. Tail longer, rounded.

Sp. *Fulix merganetta, Merganetta armata* GOULD, GRAY *Gener.* Pl. CLXX. *Merganetta chilensis* DESMURS, *Pl. peintes* 5, 48; this small and pretty species from Chili (between 34° and 35° S. L.) is referred by GOULD and GRAY to the division of the *Mergi,* yet it seems to us that it might with as much right be regarded as a sub-genus of the ducks.

Erismatura BONAP.

Biziura LEACH.

Sp. *Fulix lobata, Anas lobata* LATH., TEMM. *Pl. col.* 406; New Holland.

Oidemia FLEM.

Sp. *Fulix fusca, Anas fusca* L., BUFF. *Pl. enl.* 956, NAUM. Taf. 313; the *great sea-duck, velvet scoter;—Fulix nigra, Anas nigra* L., BUFF. *Pl. enl.* 972, NAUM. Taf. 312, the *black scoter.*

Somateria LEACH.

Sp. *Fulix mollissima, Anas mollissima* L. BUFF. *Pl. enl.* 209 male, 208 fem., GUÉRIN *Iconogr., Ois.* Pl. 67, fig. 1; the *eider-duck.* The base of the bill

is produced on each side into a lamina extending above the head; the bill and legs are greenish grey. The male is white above, black below; the female is greyish brown. This bird sometimes migrates from the north in cold seasons to our coasts; it is celebrated for its valuable down, which is chiefly collected from the nests covered with it on the inside. The seeking of these nests, which are found on high rocks, is connected with great difficulty and danger.

Harelda LEACH.

Sp. *Fulix glacialis, Anas glacialis* L., BUFF. *Pl. enl.* 1008, NAUM. Taf. 319; the *ice-duck, long-tailed Hareld,* lives in the high north and is occasionally seen on our coasts in winter.

Clangula LEACH.

Sp. *Fulix clangula, Anas clangula* L., BUFF. *Pl. enl.* 802; the *golden-eyed garrot.*

Fuligula STEPHENS.

Sp. *Fulix cristata, Anas fuligula* L., BUFF. *Pl. enl.* 1001, male adult (Pl. 1007, young of one year), NAUMANN, Taf. 310, *the red-crested pochard, le morillon.*

Note.—For other sub-genera, here omitted, see GRAY l. l. The *Anates* of this division, intermediate between the *Mergi* and the remaining *Anates,* better divers than the rest, inhabit principally the shores of the sea.

Anas L. (excl. many species). Bill with margins lamellosodentate. Nostrils placed in the ridge of bill towards the base. Hallux simple. Tarsi scutellate anteriorly, reticulate at the sides, with scales hexagonal or oblong.

Anas Boschas L., BUFF. *Pl. enl.* 776, 777, LESSON *Ornith.,* Pl. 118, fig. 1; the *wild-duck,* very common in the north of Europe and also in North America; most of the races of tame ducks are derived from this species;—*Anas tadorna* L., BUFF. *Pl. enl.* 53, NAUM. Taf. 298; the *shieldrake;*—*Anas querquedula* L., BUFF. *Pl. enl.* 946, NAUM. Taf. 303; the *garganey, la sarcelle;*—*Anas crecca* L., BUFF. *Pl. enl.* 947, NAUM. Taf. 304; the *teal,* &c.

As exotic species we may notice *Anas sponsa* L., BUFF. *Pl. enl.* 980, 981, the *Carolina duck* from North America;—*Anas galericulata* L., BUFF. *Pl. enl.* 805, 806, from China, Japan, &c.

Sub-genera: *Cairina* FLEM., *Malacorhynchus* SWAINS., *Spatula* BOIE, *Chaulelasmus* GRAY, *Pterocyanea* BONAP., *Querquedula* STEPH., *Anas* GRAY, (*Boschas* SWAINS.), *Dafila* LEACH, *Tadorna* LEACH, *Dendrocygna* SWAINS.

Choristopus EYTON, *Anseranas* LESS., GRAY. Bill moderate, somewhat thick, with margins lamelloso-dentate, the lamellæ depressed, not exsert. Hallux simple. Tarsi rather long, reticulate. Feet semipalmate.

Sp. *Choristopus melanoleucus, Anas melanoleuca* LATH., CUV. *Mém. du Mus.* XIV. 1827, Pl. 19, from New Holland; a species about the size of a stork, of which it has nearly the feet.

Anser BRISS. Bill shorter than head, narrowed towards the tip, at the base higher than broad, with conical marginal laminæ. Nostrils in middle part of bill. Tarsi reticulate. Hallux simple.

The *geese* have their legs higher and placed not so far backward as the ducks proper; hence also they run better. Their swimming membranes are shorter; they swim less and do not dive. Many species make use of vegetable food. There is no difference of plumage in the two sexes, a difference generally so remarkable in the ducks.

Cereopsis LATH. Bill short, high at the base, declivous towards the tip, convex. Nostrils placed in the cere.

Sp. *Cereopsis Novæ Hollandiæ* LATH., Suppl. II. p. 325, Pl. 138, TEMM. *Pl. color.* 209, LESS. *Ornith.* Pl. 109, fig. 1.

Anser BRISS.

Sp. *Anser cinereus* MEYER, *Anas anser ferus* L., LESS. *Ornith.* Pl. 117, fig. 2, NAUM. Taf. 285; bill yellowish-orange, black below, the wings extend to the point of the tail. From this species the different races of tame geese descend.—*Anas segetum* GM., BUFF. *Pl. enl.* 985, NAUM. Taf. 287; the bill is black at the base and the tip orange in the middle; the wings extend as far as or beyond the point of the tail. Both species migrate here in the cold season of the year.

Chenalopex STEPH.

Anser ægyptiacus, Anas ægyptiaca L., BUFF. *Pl. enl.* 379, *Ménagerie du Mus. d'Hist. nat.* 1804, 8vo, I. pp. 285—296; in Africa; according to GEOFFR. ST.-HILAIRE the χηναλώπηξ of the ancients, which was sacred amongst the Ægyptians on account of the love it shews for its young; see ÆLIAN. *de Anim. Natura*, Lib. V. 30, X. 16, XI. 38. Others refer this bird to the *Anas Tadorna* L.; see SCHNEIDER in his edition of ARISTOTELES *de Anim. Hist.* III. p. 611; F. JACOBS in his edition of ÆLIANUS follows the opinion of GEOFFROY.

Note.—Add sub-genera: *Bernicla* STEPHENS, *Nettapus* BRANDT, and some others, on which consult GRAY.

Cygnus MEIJER. Bill with margins lamelloso-dentate, at the base higher than broad, above at the base flat or depressed, not

narrowed at the tip. Nostrils in the middle of bill. Hallux simple. Tarsi reticulate, with hexagonal scales. Neck very long.

Sp. *Cygnus olor* GM., BUFF. *Pl. enl.* 913, NAUM. Taf. 295, GUÉRIN *Iconogr., Ois.* Pl. 66, fig. 1; the *swan, le cygne, der Schwan,* &c. The feathers on the whole body are white; the bill red with a black tip and black sides, a tubercle at the fore part of the head. This species lives in lakes and large ponds of the middle of Germany and in the east of Europe, and is met with almost everywhere as a tame bird, especially in the basins and ponds of many Dutch towns. The trachea in both sexes runs direct to the lungs without curvatures. On the other hand the double curvature of the trachea is remarkable in *Anas Cygnus* (*ferus*) L., BRISS. *Ornith.* VI. Tab. 28, *Cygnus xanthorhinus* NAUM., Taf. 296, the *wild swan,* a species which, with us, passes along the coast in winter, and is distinguished by its black bill, yellow only at the base, and by the absence of the tubercle on the forehead; this species broods in Lapland, Russia, Siberia, &c.— *Cygnus Bewickii* YARR., *Cygnus islandicus* BREHM, *Cygnus melanorhinus* NAUM. Taf. 297, smaller than the preceding; observed sometimes in Holland in the winter.

In New Holland there lives a black species with a red bill, *Anas atrata* LATH., *Anas plutonia* SHAW, *Cygne noir du Cap de Diemen,* LABILLARDIÈRE *Voyage à la Rech. de* LA PEYROUSE, *Atlas,* Pl. 9, LESS. *Ornith.* Pl. 117, fig. 1; swans of this species may be seen in London in St James's Park.

Family III. *Steganopodes* ILLIG. Bill long or moderate. Wings adapted for flying, long or rather long. Feet short, tetradactylous, with hallux placed internally and directed forwards, joined by membrane to the inner toe. Tarsi reticulate, with scales hexagonal.

Pelecanus ILLIG., TEMM. (species from gen. *Pelecanus* L.). Bill longer than head, broad, depressed, terminated by a hook. Nostrils basal, linear, narrow. An unplumed region at the base of bill. Lower mandible composed of two flexile branches, sustaining the lax unfeathered skin of the throat. Tail rounded, short.

The *pelicans* are large white birds, which live on fish, and occur in various countries both of the old and new world. With LINNÆUS the genus *Pelecanus* comprises almost all the species of this family; to the genus, as limited by modern writers, only few species belong. On the specific characters may be consulted, H. LICHTENSTEIN, in *Abhandl. der Akad. zu Berlin, Physik. Kl.* 1838, *Beitr. z. ornith. Fauna von California* &c. s. 17—32. The skeleton of the pelican is distinguished by its many hollow bones, its great pneumaticity. With the ancients the common European species occurs as *Onocrotalus* (PLINIUS) and Πελεκῖνος (OPPIANUS), whilst the birds named Πελεκᾶνες by ARISTOTELES were probably *Platalea,* but at least were certainly not the birds now named pelicans; BRANDT

Descriptiones et Icones Animalium Rossicorum novor., Av., Fasc. I. Petropoli, 1836, pp. 53, 54. Of this genus two species occur in Europe, of which the one was first distinguished by BRUCH (OKEN'S *Isis*, 1832, p. 1109) under the name of *P. crispus*, a species which some of the earlier writers had before them, but whose descriptions and figures were referred by LINNÆUS and later writers to *Pelecanus Onocrotalus*. *P. Onocrotalus* BRUCH (L. in part) is light rose-coloured, BUFF. *Pl. enl.* 87, NAUM. Taf. 282, BRANDT l. l. Tab. V.;—*Pel. crispus* NAUM. Taf. 283, BRANDT, Tab. VI. is larger, more of a greyish white, and has at the sides and back of the head curled feathers. Both species occur in the south-eastern parts of Europe and at the Caspian sea, *P. onocrotalus* also in Egypt.—In the west of North America *Pelec. trachyrhynchus* LATH. (see fig. in LICHTENSTEIN l. l.) lives, as is reported, as far as 61° N. L.

Sula BRISS., *Dysporus* ILLIG. Bill compressed, elongato-conic, acuminate, with margins crenate. Face and throat featherless. Claw of middle toe winged internally, incised pectinately. Wings long, narrow, with the first or the first two quills the longest. Tail cuneate.

Sp. *Sula alba* MEYER, *Pelecanus bassanus* L., BUFF. *Pl. enl.* 278 (and 986 young bird), LESS. *Ornith.* Pl. 116, fig. 2, NAUM. Taf. 278; the *John of Gaunt*, or *common gannet;* the adult bird is white with the exception of the primary flag-feathers and the bastard winglet, which are black; the size is about that of a goose. This sea-bird flies high above the sea and darts rapidly down when it descries a fish. This species is found in the northern regions of both hemispheres, in Norway, the Hebrides, &c. On the uninhabited island on the Scotch coast (*the Bass Rock*) the number of these birds is very great, and in May and June their nests and eggs cover the base of the steep rock to such a degree that it is difficult to make a footstep without treading on them (HARVEJI *De generat. animal.* Exercitat. XI.; a drawing of the rock is to be found as a title-plate to the tenth part of NAUMANN'S *Naturgesch. d. Vög. Deutschl.*). Each female, however, deposits at each brood only a single egg, which, as in most birds of this family, is much elongated and of a dull white; the young birds are eaten.—*Sula piscatrix, Pelecanus piscator* L., smaller than the preceding, with red bill and legs, in the Indian sea and at China; this species is taught by the Chinese to catch fish. The nostrils are difficult to discover in this genus; see the note above at p. 364.

Sula variegata, Dysporus variegatus TSCHUDI, lives by thousands on the island *San Lorenzo*, and is the principal *Guano*-maker. V. TSCHUDI *Peru. Reiseskizzen*, I. s. 59.

Plotus L. Bill elongate, straight, subulate, very acute, with margins obliquely incised towards the tip. Nostrils very small, placed in a groove at the base of bill. Neck very long, slender. Wings long, with second and third quills equal, longest of all. Tail long, rounded.

Sp. *Plotus Anhinga* L., BUFF. *Pl. enl.* 959, 960, LESSON *Ornith.* Pl. 114, fig. 2; from the south of North America, from South America, Surinam, Brasil;—*Plotus Levaillantii* TEMM., BUFF. *Pl. enl.* 107, TEMM. *Pl. col.* 380, GUÉR. *Iconogr., Ois.* Pl. 65, fig. 1; from Africa. The long neck looks like a snake fastened to the body of a bird. These birds make their nests in trees; they swim and dive very well.

Carbo LACEP., MEYER, *Phalacrocorax* BRISS., *Halieus* ILLIG., *Graculus* (L. previously) GOULD. Bill compressed, moderate; upper mandible hooked at the tip, lower mandible truncate. Nostrils lateral, placed in a groove at the base of bill. Claw of middle toe incised pectinately on the inner edge. Tibiæ plumed down to the joint. Outer toe longest of all. Tail rounded.

Sp. *Carbo cormoranus* MEYER, *Pelecanus carbo* L., BUFF. *Pl. enl.* 927, LESS. *Ornith.* Pl. 115, fig. 2; *common cormorant;—Carbo graculus* MEYER, *Carbo cristatus* TEMM., *Pelecanus graculus* L., *Pl. col.* 322, NAUM. 280, &c. The species of this genus are almost all coloured black, and on the whole much resemble each other. It is the most numerous of this whole order, and the most nearly allied with the preceding genus *Plotus*. On the skull of these birds a small triangular pointed bone may be remarked, which is moveably attached to the occiput.

Tachypetes VIEILL., *Atagen* MOEHR., GRAY, *Fregata* RAY, LAC. (species of *Pelecanus* L., sp. of *Sula* BRISS.). Bill long, with the tip of both mandibles curved, hooked. Nostrils linear, placed in a groove at the base of bill, narrow. Feet short, semipalmate. Tibiæ and upper part of tarsi covered with plumes; tarsi very short. Middle toe longer than outer, with claw pectinately incised internally. Wings pointed, very long. Tail long, forked.

Sp. *Tachypetes aquilus, Pelecanus Aquilus* L., BUFF. *Pl. enl.* 961, LESS. *Ornith.* Pl. 115, fig. 1, GUÉR. *Iconogr., Ois.* Pl. 64, fig. 2; the *frigate-bird.* This bird has a very large flight, and is seen at great distances from land, especially between the tropics. Compare E. BARTON *Observations on the Nat. Hist. and Anat. of the Pelec. aquilus, Transact. of the Linn. Soc.* XII. 1822, pp. 1—12. The humerus is more elongated than in *Pelecanus*, and the radius and ulna are one-third longer than the humerus.

Phaëton L. Bill moderate, cultrate, with margins finely incised. Nostrils in base of bill, lateral, pervious. Wings pointed, long. Feet palmate, short, with tibiæ naked above the heel. Toes moderate; hallux short. Tail with two middle quills very long, filiform, with shaft subnude.

The tropical birds by their rapid and high flight attract the attention of mariners, whose ships they frequently accompany between the tropics.—

Sp. *Phaëton æthereus* L., BUFF. *Pl. enl.* 998, LESS. *Ornith.* Pl. 114, fig. 1; —*Phaëton phœnicurus* GM., BUFF. *Pl. enl.* 979, GUÉR. *Iconogr., Ois.* Pl. 65, fig. 3;—*Phaëton flavirostris* BRANDT, *Lepturus candidus* BRISS. *Ornith.* VI. Tab. 42, fig. 2,. BUFF. *Pl. enl.* 369. Compare J. F. BRANDT *Tentamen monographiæ generis Phaëton, Mém. de l'Acad. impér. des Sc. de St. Petersbourg,* 6ième Série, *Sc. math. et phys.* Tome V. 2, 1839. (These birds recall *Sterna* and *Larus,* but must, nevertheless, be referred to the family of the *Steganopods.*)

Family IV. *Longipennes.* Bill with margins entire. Wings elongate. Feet stilted, with tibiæ seminude, in some tetradactylous, with hallux free, posterior, simple, in some tridactylous, with hallux none.

A. *Nostrils linear, placed at the base of bill, pervious.*

Rhynchops L. Bill long, compressed, straight; lower mandible two-edged towards the tip, longer than upper, with tip truncate. Feet tetradactylous, with palmar membrane excised. Wings very long; first two quills longer than the rest.

Sp. *Rhynchops nigra* L., BUFF. *Pl. enl.* 357; LESSON *Ornith.* Pl. 113, fig. 1, from America; another species occurs in the eastern hemisphere, *Rhynchops flavirostris* VIEILL., *Rh. orientalis* RUEPP. *Atlas* Pl. 24. The lower mandible with its sharp upper edge is received in a groove of the upper mandible like the blade of a pocket-knife in its handle.

Sterna L. Bill long, straight, compressed, pointed, with mandibles subequal, the lower shorter. Feet small, tetradactylous, with palmar membrane mostly excised; tarsi scutellate anteriorly. Wings very long, with first quill-feather longer than the rest.

a) *Tail cuneate, longer. Palmar membrane scarcely excised, large.*

(Sub-genus *Anous* LEACH, GRAY, *Megalopterus* BOIE.)

Sp. *Sterna stolida* L., BUFF. *Pl. enl.* 997, the *Noddy;* on the Atlantic Ocean between the tropics, Indian Ocean and South Pacific, &c.

b) *Tail forked, or emarginate. Palmar membrane deeply excised between the toes.*

Sub-genus *Sterna.* (*Sterna* GRAY, with addition of sub-genera *Hydrochelidon* BOIE, GRAY, *Phætusa* and *Gygis* WAGL. and GRAY.)

Sp. *Sterna hirundo* L., BUFF. *Pl. enl.* 987, LESSON *Ornith.* Pl. 113, fig. 2, the *sea-swallow;* bill and legs red, head on the top as far as the eyes black, body light-grey above, white below; the same colours in *Sterna minuta* L., BUFF. *Pl. enl.* 998, NAUMANN, Taf. 254, which, however, is much smaller, and in addition is distinguished by white above the eyes. Similarly

coloured as *Sterna hirundo*, but much larger and with black legs, is *Sterna caspia* PALL., NAUM. Taf. 248, seldom observed with us; its nests cover the dunes on the island Sylt (see a drawing in NAUMANN *Ueber den Haushalt der nordischen Seevögel.* Leipzig, 1824, Tab. II). Other species are dark grey, and have in the summer plumage a black breast, *Sterna nigra* L., NAUM. Taf. 256. These birds live together in flocks on the sea-coast, and lay mostly two or three brown and black spotted eggs. This genus comprises very many species from all parts of the world.

Larus L. Bill moderate, compressed, cultrate; upper mandible with tip subhooked, lower, with angle below the tip somewhat prominent. Wings elongate, pointed. Tarsi scutellate anteriorly, rather robust. Feet palmate; hallux short, raised, sometimes none. Tail moderate.

Mews, Gulls.—These birds live mostly on fishes, molluscs and insects, some on carrion also; they fly long and take their prey out of the water while flying with their strong bill; there are also species which attack and rob other sea-birds of their prey.

Larus ILLIG. Nostrils placed in the middle of bill.

a) *Tail forked.* Sp. *Larus Sabinii, Linn. Transact.* XII. Pl. 29; Greenland. (Sub-genus *Xema* LEACH, GRAY, related to the *Sterns.*)

b) *With tail even.* Sp. *Larus ridibundus* L., BUFF. *Pl. enl.* 969, 970, NAUM. Taf. 260; the *black-headed Gull;* white, light bluish gray above, like most of the species; legs red; head and throat in the summer plumage brownish black.—*Larus argentatus* BRUENNICH, GM., BUFF. Pl. 253 (the hallux is faultily absent in this, otherwise correct, figure), LESSON *Ornith.* Pl. 112, fig. 2; the *great sea-mew, silver-mew, herring-gull;* very numerous on the islands along the north coast of Holland, where their eggs cover whole districts; from these gulls' eggs the northern part of Texel has obtained the name of Eijerland.—*Larus tridactylus* L., BUFF. *Pl. enl.* 387, NAUMANN, Taf. 262, &c.

These birds moult twice in the year. The males are larger than the females, but with the same colours. The young birds are mostly grey, with black or brown spots, and have sometimes been named as different species; thus *Larus nævius* L. is the young bird of *Larus marinus* L. This genus also, although not so large as *Sterna,* counts many species.

Lestris ILLIG., *Stercorarius* BRISS. Bill covered with a cere beyond the middle. Nostrils placed at the extremity of bill. Two middle tail-feathers often elongate.

Sp. *Larus parasiticus* L., BUFF. *Pl. enl.* 762, NAUM. Taf. 272, 273 (younger *Larus crepidatus* GM., BUFF. *Pl. enl.* 991, not *Lestris crepidata* BREHM, *Lestris Buffonii* BOIE), LESSON *Ornith.* Pl. 111, fig. 2, NAUM. Taf. 272, 273, &c. These *mews of prey* are very ravenous and courageous, and attack

sea-swallows and gulls which they have seen to capture fish, until these let fall or disgorge the prey seized or swallowed, which then they catch with watchful rapidity.

B. *Nostrils tubular.* Feet tridactylous, with tarsi reticulato-squamose.

Haladroma ILLIG., *Pelecanoides* LAC., GRAY. Bill short, depressed at the base, compressed at the tip, hooked. Nostrils superior, contiguous. Wings short, with first quill longest. Tail short, rounded.

Sp. *Haladroma urinatrix, Procellaria urinatrix* GM.; New Holland;—*Haladroma Berardii* QUOY, TEMM. *Pl. col.* 517; from the Falkland Islands. These small birds from the southern hemisphere much resemble *Alca* or *Mergulus*, but are easy to distinguish by the covering of the tarsi.

Pachyptila ILLIG., *Prion* LAC., GRAY. Bill moderate, depressed at the base, with margins beset posteriorly with parallel lamellæ. Nostrils tubular, placed above the culmen of bill, opening by two apertures. Wings moderate. Tail moderate, rounded. Claw sessile, remote, in place of hallux.

Sp. *Pachypthila vittata, Procellaria vittata* FORST., GM., TEMM. *Pl. col.* 528, CUV. *R. ani., éd. ill., Ois.* Pl. 91, fig. 4; South Africa, &c.

Puffinus RAY, BRISS. Bill moderate, slender, with tip of each mandible curved. Nostrils tubular, placed above culmen of bill, opening with double aperture. Wings long, pointed. Tail somewhat short, rounded. Remote claw in place of hallux.

Sp. *Puffinus major* FABER, *Procellaria Puffinus* L. (in part), BUFF. *Pl. enl.* 962;—*Puffinus anglorum* RAY (*Procell. Puffinus* L. in part), *Puffinus arcticus* FABER, NAUM. Taf. 277, &c.

Procellaria L. (excl. many species), ILLIG. Bill moderate or short, hooked at the tip; lower mandible shorter, with angle somewhat prominent. Nostrils in a tubule above the culmen of bill, opening by a single aperture, divided by a partition. Wings long. Tail mostly rounded. Claw sessile, raised, in place of hallux.

Thalassidroma VIGORS, *Hydrobatus* BOIE. Tarsus longer than toes, slender. Wings with second and third quills subequal, longer than first, the second longest of all. Tail even.

Sp. *Procellaria pelagica* L., BRISS. *Ornith.* VI. Pl. 13, fig. 1, NOZEM. *Nederl. Vog.* III. bl. 245, NAUM. Taf. 275, fig. 1, GUÉR. *Iconogr., Ois.* Pl. 62,

fig. 1; the *storm-bird*. This bird is so fat that the inhabitants of Feroë, according to BRUENNICH, string it to a wick and so use it for a lamp or candle.

Procellaria VIGORS, GRAY and others. Tarsus shorter than middle toe. (Wings pointed, with first quill longer than the rest.)

Sp. *Procellaria capensis* L., BUFF. *Pl. enl.* 964, LESSON *Ornith.* Pl. 111, fig. 1;—*Proc. glacialis* L., BUFF. *Pl. enl.* 59, NAUM. Taf. 276, &c. Compare on this and the preceding genus KUHL *Beiträge zur Kenntniss der Procellarien in Beitr. zur Zoologie und vergl. Anatom.* s. 135—149.

Diomedea L. (excl. *Diomedea demersa*), ILLIG., GRAY, *Albatrus* BRISS. Bill longer than head, thick; culmen separated by a groove; tip hooked; lower mandible with tip compressed, truncate. Nostrils lateral, at the base of groove, opening forwards. Wings elongate, with second quill longest. Feet short, robust.

Sp. *Diomedea exulans* L., BUFF. *Pl. enl.* 237; the *albatross*, often noticed by voyagers, is a large sea-bird of the southern hemisphere, like some other species, as *Diom. melanophrys* TEMM. *Pl. col.* 456, GUÉRIN *Iconogr., Ois.* Pl. 62, fig. 5, &c.

ORDER II. *Grallatores.*

Feet stilted for wading, with tarsi long, toes either cloven or lobate, or palmate, or semipalmate. The whole tibia with the lower part of femur exsert. Neck moderate or elongate. Bill mostly elongate, of various form. Wings elongate.

Waders.—In most of them a large part of the tibia is unfeathered, and, like the long tarsi, is covered with a horny investment. In some snipes, especially in *Scolopax rusticula*, this part is very small and confined to the posterior surface of the lower part of the tibia only, over which however the feathers placed higher up extend; in most, however, it is very large, especially in *Himantopus* and *Recurvirostra*. These birds, for the most part, live in fenny districts or on the banks of rivers. Many live on animal food, on insects, worms, &c., or, if they have a strong bill, swallow fishes, reptiles, and even small mammals. Most of the species fly very well, and during their flight keep their legs extended backwards.

Family V. *Macrodactyli.* Feet tetradactylous, with toes elongate, sometimes lobate. Tarsi covered anteriorly with transverse scutella. Wings moderate or short. Body slender; breast compressed, with sternum narrow.

Podoa ILLIG., *Heliornis* BONNAT., GRAY. Bill moderate, compressed, carinate; nostrils pervious, lateral. Wings with third quill, or with third, fourth, and fifth quills the longest. Tail rounded. Feet short, with toes elongate, lobate. Neck elongate.

a) *Tail broad. Toes conjoined at the base.*

Sp. *Podoa surinamensis, Plotus surinamensis* GM., BUFF. *Pl. enl.* 893, LESS. *Ornith.* Pl. 107, fig. 2.

b) *Tail narrow. Toes lobate, free at the base.*

Another larger species of the size of a duck: *Podoa senegalensis* LESSON, GRAY *Gen. of Birds*, Pl. CLXXIII.; from the west coast of Africa. Not long ago a third species from *Malacca* was made known, *Podoa* (*Podica*) *personata* GRAY, *Proceed. of the Zool. Soc.* 1848, p. 90.

These birds neither belong to *Plotus*, nor ought they to be placed with *Podiceps;* the skeleton of the African species in the Leyden Museum indicates in the small flat *sternum*, the short wing-bones (*os humeri, radius* and *ulna*) and other peculiarities, the nearest correspondence with *Fulica*.

Fulica BRISS., ILLIG. (species from gen. *Fulica* L.). Bill moderate; upper mandible gradually deflected, thick, compressed, extending into an unplumed shield over the forehead. Nostrils pervious, lateral, placed in the middle of bill. Wings short, with second and third quills longest of all. Tail short. Feet moderate, with toes very long, lobate.

Sp. *Fulica atra* L. (and *aterrima* ejusd.), BUFF. *Pl. enl.* 197, LESSON *Ornith.* Pl. 106, fig. 2, NAUM. Taf. 241; the *common coot, la foulque ou morelle, das Wasserhuhn;* black, belly slate-coloured, shield on the head white; the size of a hen. The coot lives on insects, worms and water-plants, and lays eight or more eggs in a nest that floats amongst the bulrushes. This bird migrates from us (Holland) in November and returns in March; in more southern countries of Europe it is a permanent bird.

Porphyrio BRISS., TEMM. (species of *Fulica* L.). Bill shorter than head, high, compressed, continued into a shield extending over the forehead. Nostrils rounded, lateral, pervious. Wings moderate. Feet long, strong. Toes very long, surrounded by a narrow membrane.

Sp. *Porphyrio veterum* GM., *Porphyrio hyacinthinus* TEMM., EDWARDS *Birds*, Pl. 87, LESS. *Ornith.* Pl. 105, fig. 2; in Sardinia, Calabria and the Grecian Archipelago; the *Porphyrio* of the ancients (*Laudatissima et nobilissima avis, cui rostrum et prælonga crura rubent.* PLINIUS Lib. X. c. 46; comp. also c. 49). With this bird of southern Europe a species from South Africa is commonly confounded, *Porphyrio Madagascariensis* LATH., *Porphyrio smaragnotus* TEMM., *Fulica porphyrio* L., BUFF. *Pl. enl.* 810, GUÉR. *Iconogr., Ois.* Pl. 58, fig. 2.—*Porphyrio indicus* HORSF., *Porphyrio smaragdinus* TEMM. *Pl. color.* 421, occurs at Java, &c.

Gallinula Briss., Lath., Temm., *Stagnicola* Brehm. Bill moderate, compressed, curved at the tip, extending into an unplumed shield on the forehead. Nostrils placed in a groove of the bill, longitudinal, pervious. Feet elongate, with anterior toes surrounded by a narrow membrane. Wings moderate, with second, third, and fourth quills subequal, longest of all.

Sp. *Gallinula chloropus* Lath., *Fulica chloropus* L., Buff. *Pl. enl.* 877, Less. *Ornith.* Pl. 105, fig. 1, Naumann Taf. 240; the *water-hen, common gallinule;* the legs yellow green with a red ring above the tarsi; the base of the bill, which is yellow at the tip, red; back dark olive-coloured; breast and belly grey. This bird feeds on worms, insects, small slugs and water-plants, lives amongst the reeds, swims well, and lays from six to eleven eggs, coloured dirty white or yellowish, with larger and smaller brown spots.—*Gallinula phœnicura* Penn., Buff. *Pl. enl.* 896, from Java, Celebes, &c.

Tribonyx Dubus. Bill shorter than head, subproduced on forehead, compressed. Nostrils placed in a groove near the middle of bill. Wings short, tuberculate, with fourth, fifth, and sixth quills subequal, longest of all. Toes moderate, strong.

Sp. *Tribonyx Mortieri* Dub., *Bullet. de l'Acad. de Brux.* vii. 215; New Holland.

Here is to be noted the genus *Notornis* Owen, supposed to be extinct until lately proved to be still living in New Zealand. See Mantell *Ann. and Magas. of Nat. Hist.* 1852, Vol. ix. p. 231; also Gould *ibid.* p. 234, and *Trans.* of the Zool. Soc. ii. 2, 1852, Pl. 25 (described as *Notornis Mantelli*, from the skin supplied by Mantell). It is of the size of *Porphyrio*, resembles it in the bill and colour, but has feet like *Tribonyx*. It is however unable to fly, and resembles the Ostrich in the wings and tail.

Ocydromus Wagl., *Gallirallus* De Lafren.

Rallus L. (in part). Bill moderate, or longer than head, compressed, without frontal shield. Nostrils placed in a groove, pervious, narrow. Feet elongate. Wings moderate, with second and third quills subequal, mostly longest of all.

Crex Bechst., *Ortygometra* L. (*Faun. Suec.* 1744), Gray, *Porzana* Vieill., *Zapornia* Leach. Bill shorter than head, high at the base; lower mandible angulate.

Sp. *Rallus Crex* L., *Crex pratensis* Bechst., *Gallinula crex* Lath., Temm., Buff. *Pl. enl.* 750, Naum. Taf. 236; this bird is more a land-bird than the water-hen; it runs very rapidly, flies little and, when pursued, not far;

lives amongst the high grass in meadows and corn-fields. Since in our latitudes it comes with the quails (in June) and migrates with them (in October), it has been named *Kwartelkoning, Roi des cailles, Wachtelkönig, king of the quails;* the *land-rail, corn-crake.—Rallus Porzana* L., NAUM. Taf. 237, &c.

Rallus LATH., TEMM. Bill longer than head, straight or subarched.

Sp. *Rallus aquaticus* L., BUFF. *Pl. enl.* 749, LESSON *Ornith.* Pl. 106, fig. 1, NAUM. Taf. 235; the *water-rail;* lives on the banks of rivers and brooks, in moist, rushy meadows, runs very rapidly on water-lilies (*Nymphææ*) and other water-plants.—*Rallus Madagascariensis* VERREAUX, *Biensis typus* PUCHERAN, DES MURS *Pl. peintes,* 24, &c.

Aramides PUCHERAN. Bill longer than head; lower mandible shorter than upper, angulate. Wings with fourth and up to seventh quills subequal, longer than the rest.

Sp. *Rallus maximus* VIEILL., *Fulica cayensis* GM., BUFF. *Pl. enl.* 352;—*Rallus plumbeus* TEMM., *Gallinula plumbea* SPIX, &c. Large species from South America.

Note.—Add *Corethrura* REICHENB., *Alecthelia* SWAINS. not LESS., and *Eulabeornis* GOULD; comp. GRAY *Genera of Birds.*

Parra L. Bill moderate, straight, compressed, a little thickened at the tip. Nostrils ovate, placed in the middle of bill, pervious. Wings spurred or tuberculate, with first three quills subequal, longest. Tarsi elongate, with toes very long, thin, anterior subequal, with claws acuminate, long; posterior claw very long.

* With forehead carunculate. Tail very short. Second and third quills longest.

Sp. *Parra Jacana* L., BUFF. *Pl. enl.* 322, LESSON *Ornith.* Pl. 92, fig. 2, the *surgeon;* in the tropical regions of South America;—*Parra cuprea* VAHL, mihi, *Parra superciliosa* HORSF., *Parra melanochloris* VIEILL., VAHL *Naturh. Selskabets Skrivter,* IV. 1, 1794, Pl. 2; the largest known species; head, neck, breast and belly violet-black, wings and back copper-coloured green, a white streak from the eyes to the neck; in Bengal and Java;—*Parra gallinacea* TEMM. *Pl. col.* 464, Java, Celebes;—*Parra albinuca* ISID. GEOFFR. ST.-HIL., GUÉR. *Iconogr., Ois.* Pl. 57, fig. 1, Madagascar, &c.

** With forehead plumed, without caruncles. Four middle tail-feathers very long; anterior flag-feathers appendiculate, first and second equal, longer than third. *Hydrophasianus* WAGL., GRAY.

Sp. *Parra sinensis* GM. (and *lusoniensis* GM.), *Dict. univ. d'Hist. nat., Ois.* Pl. X. fig. 1; the young bird SONNERAT *Voy. à la nouv. Guinée,* Pl. 45; Java, Manilla, &c.

The birds of this genus live in the tropical regions of both hemispheres, and in their mode of life agree with the water-rail of Europe.

Family VI. *Longirostres* s. *Scolopacidæ* SWAINS. Bill mostly elongate (in a few moderate), slender, soft. Nostrils placed in a groove of bill. Feet with toes moderate, hallux mostly short, raised, sometimes none. Wings rather long, with first quill mostly longest of all.

Longbills.—These birds form the most typical family of the order, since the preceding family has some resemblance to the gallinaceous birds. Most of the species of this family live on insects, for which they feel, and seize them with their bill on or under the ground or in the mud. It is remarkable that the snipes, the sandpipers (*Tringæ*) and the godwits (*Limosæ*) are able to move the extremity of the upper mandible separately, by which they are distinguished from the genus *Totanus*, as LEISLER first remarked (TEMMINCK *Manuel d'Ornith.* II. p. 636). These birds can find worms and insects under the mud or in the loose earth with their bill simply by touch; to that end the tip of the bill is supplied with many nervous filaments from the fifth pair which pass through small bony cavities of the upper mandible. See NITZSCH in MECKEL'S *Archiv f. d. Physiol.* II. s. 369—380, III. s. 384—388.

Scolopax L. (in part), ILLIG., TEMM., CUV. Bill elongate, slender, soft, somewhat round. Upper mandible with tip obtuse, produced beyond the lower, grooved from the base to beyond the middle part. Nostrils basal, linear. Eyes large, distant from the base of bill, placed towards the upper part of head. Feet moderate; tarsi scutellate anteriorly; anterior toes unequal, the middle toe far surpassing the lateral; hallux short, resting on its point. Tail short, rounded.

The *snipes.*—Some species live in woods, others in fenny districts or on moist meadows. They mostly feed exclusively on insects, worms and slugs; some add to these plants and seeds, especially of species of grass (*Scolopax gallinula*). In Holland they seldom brood, but are birds of passage, which visit us in the spring and especially the autumn; they pass the summer in northern countries. They moult twice in the year, but there is no remarkable difference between the winter and summer plumage, neither is there between the colour of the feathers of the two sexes and that of young and old birds.

a) *With first, second and third primaries gradually longer, fourth and fifth longest of all.*

Sp. *Scolopax microptera* mihi, *Scolopax minor* WILSON, *American Ornithology*, Pl. 48, fig. 2, in North America; very similar to the European woodcock, but smaller. This species forms the genus *Philohela* of GRAY.

b) *With first and second primaries subequal, longest of all.*

* *With tibiæ covered with plumes as far as the heel. Posterior claw obtuse, not produced beyond hallux.* (Sub-genus *Scolopax* BOIE, BREHM, GRAY.)

Sp. *Scolopax rusticula*[1] L., BUFF. *Pl. enl.* 858, LESS. *Ornith.* Pl. 101, fig. 1, NAUM. Taf. 211; the *woodcock, la bécasse;* the largest species; the head is grey in front, yellow-brown with transverse darker brown streaks behind; the feathers are also yellow, ruddy brown, black and grey, in a combination that recalls the plumage of *Caprimulgus* or of *Strix flammea*. The woodcock is a nocturnal animal, and in the day-time hides in woods; this species is met with all over Europe, in the north of Asia and also in Japan.

** *With tibiæ denuded above the heel. Posterior claw slender, produced beyond hallux.* (Sub-genus *Gallinago* LEACH, GRAY, *Telmatias* BOIE, BREHM, *Ascalopax* KEYSERLING and BLAS.)

Sp. *Scolopax gallinago* L., BUFF. *Pl. enl.* 883, NAUM. Taf. 209; the *common snipe, la bécassine;*—*Scolopax gallinula* L., BUFF. *Pl. enl.* 884, NAUM. Taf. 210; the *Jack-snipe, la sourde, la petite bécassine;* this species, like *Scol. rusticula*, has 12 tail-feathers, the common snipe 14. In an Indian species much resembling *Scol. gallinago*, 24 to 26 are counted: *Scol. stenura* KUHL, Java and Sumatra.

Limosa BRISS., LEISL., TEMM. (*Actitis* ILLIG. in part). Bill very long, slender, straight or sub-recurved at the tip. Lateral groove running as far as the tip. Nostrils basal, pervious. Feet with tibiæ denuded for a large space below, with tarsi long, scutellate anteriorly; outer and middle toe conjoined by membrane; hallux resting on the tip. Wings moderate, with first quill longest of all. Tail short, even.

Sp. *Limosa melanura* LEISL., *Scolopax limosa* L. and *Scol. ægocephala* L., BUFF. *Pl. enl.* 874 (*winter plumage*), 916 (*summer plumage*), LESS. *Ornith.* Pl. 101, fig. 2, NAUM. Taf. 212, 213; the *black-tailed godwit, la barge, der Sumpfläufer, de marel*; the largest species; tail black, at the base white; it lives in marshy districts and at the mouth of rivers in many parts of Europe and Asia (also in Japan); lays four dark olive-coloured eggs with large brown spots, which are as much prized as those of the plover.—*Limosa rufa* BRISS., *Scolopax lapponica* L., BRISS. *Ornith.* v. Pl. 25, fig. 1, BUFF. *Pl. enl.* 900, &c.

Here belongs also a species with quite straight bill, which lives in North America, and is occasionally found in England, and which is generally referred to *Scolopax, Limosa scolopacea* SAY, *Scolopax grisea* (and *noveboracensis*) LATH., GMEL., WILSON *Amer. Ornith.* Pl. 58, fig. 1, (ed. JARDINE, Vol. II. p. 337), GOULD *Birds of Europe*, Pl. 323; *Macroramphus* LEACH, GRAY.

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[1] With LINNÆUS properly *rusticola*, probably from a mistake of the pen.

Totanus BECHST., CUV., TEMM. (spec. of *Scolopax* L., spec. of *Tringa* BRISS.). Bill moderate or elongate, straight or ascending, compressed, acuminate, harder at the tip. Feet elongate, with tarsi slender, scutellate anteriorly. Middle toe conjoined at the base with outer by membrane; hallux scarcely resting on the ground. Wings moderate, with first quill longest.

Sp. *Totanus fuscus* LEISL., *Scolopax fusca* L., BUFF. *Pl. enl.* 875, NAUM. Taf. 200; the *dusky sandpiper;* feeds on small fresh-water conchifers and insects;—*Totanus calidris* BECHST., *Scolopax calidris* L., BUFF. *Pl. enl.* 827, 845, NAUM. Taf. 199; the *red-shank sandpiper;* base of the bill red, legs yellow-red; this bird broods in large quantities on the meadows in Holland.

The species with the bill curved upwards form the genus *Glottis* of NILSSON and BREHM, *Totanus glottis* BECHST., *Scolopax glottis* L., NAUM. Taf. 201, the *green-shank;* this bird, besides water-insects, feeds on small fishes.

Sub-genus: *Actitis* BREHM, KEIJSERL. and BLAS., *Tringoides* BONAP., GRAY. Groove of bill extending to the tip. Tail produced beyond the points of the wings.

Sp. *Totanus hypoleucus* TEMM., *Tringa hypoleucos* L., BUFF. *Pl. enl.* 850, NAUM. Taf. 194; *common sandpiper.*

Himantopus BRISS., *Hypsibates* NITZSCH. Bill elongate, straight, slender, acuminate, with groove extending on each side to the middle. Nostrils linear, lateral. Feet very long, very thin, with tarsi reticulate. Toes moderate, conjoined at the base; expanded membrane between the outer toes. Wings very long, pointed, with first quill much surpassing the rest. Tail subeven, short.

Sp. *Himantopus melanopterus* MEYER, *Charadrius Himantopus* L., BUFF. *Pl. enl.* 878, LESSON *Ornith.* Pl. 104, fig. 1, NAUM. Taf. 203; white, the back and wings greenish black and shining; the long legs red. This bird, closely allied to *Totanus*, has at first sight some resemblance to a stork in miniature; it lives in the South and particularly the South-East of Europe, and in some parts of Asia and Africa. *Himantopus*, under which name this bird occurs in PLINIUS, Lib. IX. cap. 47, denotes that the legs are as thin as string, *loripes.*—A very similar species occurs in North America: *Himantopus Wilsonii* TEMM., *Avocetta Himantopus* WILSON, *American Ornith.* Pl. 58, fig. 2; another at New Holland, New Guinea, Timor, &c., *Himantopus leucocephalus* GOULD.

Cladorhynchus GRAY, *Leptorhynchus* DUBUS.

Note.—Characters nearly of the preceding genus, but feet palmate, tarsi more robust; this form is intermediate between the preceding genus and

that which follows next, as though three genera met and were confluent.—Sp. *Cladorhynchus pectoralis* GRAY, *Himantopus palmatus* GOULD, DUBUS in GUÉRIN *Magasin de Zool.* 1835, *Ois.* Pl. 45; hab. in New Holland.

Recurvirostra L. Bill elongate, slender, ascending. Nostrils narrow, linear, placed in a groove of bill. Feet elongate, slender, palmate, tetradactylous, with hallux raised, very short. Tarsi reticulate. Wings somewhat long, with first quill longest. Tail short, rounded.

Sp. *Recurvirostra Avocetta* L., BUFF. *Pl. enl.* 353, LESS. *Ornith.* Pl. 104, fig. 2; the *scooping avocet;* white, the head and neck black, the wings black and white, the legs bluish or lead-coloured; this species lives on the sea-coast and on lands flooded by sea-water; the female lays 2 or 3 dirty-yellow eggs spotted black or brown. Of this genus also some exotic species occur which differ little in size and often also in colour from the European species. *Recurvirostra americana* LATH., WILS., Tab. 63, fig. 2, from North America, has the head and neck, as also the upper part of the back, reddish or dun-yellow.

Tringa L. (excl. of species). Bill moderate or a little longer than head, soft, flexile, straight or inflected at the tip, with tip depressed, obtuse. Groove extending from the base of bill almost to the tip. Feet moderate, slender, with tarsi scutellate anteriorly, with toes cloven or outer and middle toes joined at the base by membrane. Hallux resting on its point, or none. Wings long, with first quill longest. Tail even or cuneate, with two middle feathers subproduced.

A. *Toes cloven.*

† *Feet tridactylous, hallux none.*

Sub-genus: *Calidris* ILLIG., TEMM. (*Arenaria* BECHST.). Bill moderate, straight.

Sp. *Tringa arenaria* L. (and *Charadrius calidris*), BRISS. *Ornith.* v. Pl. 20, fig. 2, NOZEM. *en* SEPP *Nederl. Vogels,* III. p. 283, fig. 1, (the winter plumage), fig. 2, the summer plumage (*Charadrius rubidus* GM.), NAUM. Taf. 182; the *sanderling, la petite maubèche grise;* except that the hallux is absent, in all respects a true *Tringa* species.

† *Hallux short, raised.*

Sub-genus: *Tringa* BRISS., TEMM. Bill moderate (*Calidris* CUV., *Canutus* BRISS., BREHM) or longer than head (*Pelidna* CUV.).

Sp. *Tringa canutus* L., *Tringa islandica* GM., NAUM., *T. grisea* GM., *Tringa cinerea* GM., TEMM., BUFF. *Pl. enl.* 365, 366, NAUM. Taf. 183; the *knot,*

ash-coloured sandpiper, la maubèche; compare for the synonomy TEMMINCK, *Manuel*, II. pp. 628—630;—*Tringa maritima* BRUNNICH, NAUM. Taf. 188; the *purple sandpiper*;—*Tringa cinclus* L. (and *Tringa alpina* ejusd., NAUM.), *Tringa variabilis* MEYER, BUFF. *Pl. enl.* 852; NAUM. Taf. 187, &c.; the *dunlin*. A small species *Tringa minuta* LEISLER, NOZEMANN *en* SEPP *Nederl. Vog.* III. 27, the *stint* or *sea-lark*, is scattered far over the eastern hemisphere, through Europe, Africa, the Sunda Isles, New Guinea and New Holland, from all of which localities there are specimens in the *Rijks-Museum* at Leyden.

A species with a long bill, curved downwards, *Tringa subarquata* TEMM., *Scolopax subarquata* GM. (and *africana* ejusd.), BUFF. *Pl. enl.* 851, NAUM. Taf. 185, which occurs in Europe, Asia and India, has given occasion, from a pair of specimens in which the bill had been distorted and the thumb cut off, for forming the nominal genus *Falcinellus* CUV.; a figure is to be seen in TEMM. *Pl. color.* 510. See SCHLEGEL *Kritische Uebersicht der Europäischen Vögel*, Leyden, 1844, s. 97, 98.

In one species the bill is long and pressed flat, *Tringa platyrhyncha* TEMM., *Numenius pygmæus* LATH., NAUM. Taf. 207. On this is founded the genus *Limicola* KOCH, KEYSERL. BLAS. This species has some resemblance, especially in the plumage, to *Scolopax gallinula*.

B. *Membrane between the outer and middle toes.*

Sub-genus: *Machetes* CUV., *Philomachus* MOEHR., GRAY.

Sp. *Tringa pugnax* L., BUFF. *Pl. enl.* 305 male, 306 fem., LESSON *Ornith.* Pl. 103, fig. 2, NAUM. Taf. 190—193; the *ruff* male, *le combattant, paon de mer*, fem. *reeve*. This bird broods in numbers with us, lives on moist pastures, and migrates in autumn. The males, larger than the female, are at pairing time ornamented with a ruff of feathers and very variously marked. In May they pass a great part of the day on some battle-field, and attack each other furiously with their bills. The female lays 4 or 5 pointed eggs coloured green with brown speckles.

C. *Anterior toes conjoined at the base by membrane.*

Sub-genus: *Hemipalama* BONAP., GRAY.

Sp. *Tringa himantopus* BONAP., SWAINSON and RICHARDSON, *Fauna boreali-Amer., Birds*, Pl. 66.

Heteropoda NATALL.

Eurynorhynchus NILSSON.

Note.—Genus related to the *Tringæ*, with bill depressed, dilated at the tip. Sp. *Eurynorhynchus griseus* NILSS., *Platalea pygmæa* L. *Mus. Ad. Frid., Tomi sec. Prodrom.* Holmiæ, 1764, p. 26. See figure in GRAY *Gen. of Birds*, Pl. CLII. This very rare bird is not an inhabitant of Surinam, as stated by LINNÆUS, but of the East Indies.

Phalaropus Briss. Bill moderate or slightly longer than head, soft, straight, with tip inflected: Tarsi moderate, covered in front with scutella; feet tetradactylous, with anterior toes connected at the base by membrane, pinged or lobate. Wings pointed, with first and second quills subequal, longest of all.

a) *With bill slender, subulate.* Subgen. *Lobipes* Cuv.

Sp. *Phalaropus Wilsonii* Sabine, *Phalaropus fimbriatus* Temm. *Pl. col.* 370, *Fauna boreali-Americana, Birds*, Pl. 69, p. 405. In this species, which occurs in North and South America, the toes have only a narrow border; the legs are longer and more slender than in the other species; *Phalaropus cinereus* Briss., *Tringa hyperborea* L. (and *lobata* ejusd.), *Phalaropus angustirostris* Naum., Buff. *Pl. enl.* 766, Sturm *Deutschl. Fauna, Vögel*, Heft 2, Naum. Taf. 205; Lapland, Iceland, Greenland, the Orkney Islands; the male broods as well as the female, and is said to have exclusively a brooding spot on each side of the belly, a part denuded of feathers. This small species has, as also the following, a lobed membrane along the toes, like *Fulica*.

b) *With bill broad, depressed.*

Sp. *Phalaropus fulicarius* Bonap., *Phalaropus platyrhynchus* Temm., *Tringa fulicaria* L., Less. *Ornith.* Pl. 107, fig. 1, Naum. Taf. 206, Cuv. *R. Ani., éd. ill., Ois.* Pl. 81, fig. 2; this species resides, like the preceding, in the high north of both hemispheres, and descends only seldom towards temperate regions; has however been repeatedly shot both on the Dutch and English coasts. It is larger than the preceding, about the size of *Tringa cinclus*.

Rhynchæa Cuv. Bill elongate, sub-arched. Lateral groove extending to the tip of upper mandible. Nostrils pervious, basal. Feet moderate, with tarsi scutellate in front, toes cloven, hallux raised, resting only by the tip. Wings moderate, ample, with first three quills longer, subequal, second longest of all.

Sp. *Rhynchæa varicgata* Vieill., *Rhynchæa variabilis* (Cuv.?) Temm., *Scolopax capensis* L. and *Rallus bengalensis* ejusd., Buff. *Pl. enl.* 922 adult, 270, 881 (younger), Less. *Ornith.* Pl. 102, fig. 1; Africa, India (Sumatra, Java), Japan.—In South America, Brasil, Peru, a smaller species occurs: *Rhynchæa semicollaris* (*Totanus semicollaris* Vieill. *Nouv. Dict. d'Hist. nat.*), *Rhynchæa Hilairea* Valenc., Lesson *Illustr. de Zool.* Pl. 18, Guér. *Iconogr., Ois.* Pl. 55, fig. 2.

Numenius Moehr., Briss. (in part), Cuv. Bill long, slender, curved, with tip of upper mandible hard, obtuse, produced beyond the tip of lower. Nostrils basal, lateral, linear, pervious, placed in groove obliterated towards the tip of bill. Face plumed. Feet slender, elongate; tarsi covered anteriorly with transverse scutella,

in the upper part mostly with hexagonal scales. Toes short; three anterior bordered by a narrow membrane and connected at the base; hallux resting on its point. Wings with first quill longest.

Sp. *Numenius Arquata* LATH., TEMM., *Scolopax Arquata* L., BUFF. *Pl. enl.* 818, LESS. *Ornith.* Pl. 100, fig. 2, NAUM. Taf. 216; the *common curlew;* broods on the dunes in Holland, inland in England on elevated spots; this species occurs in Europe, Asia and North Africa. Another smaller, with short bill, is also very common in Holland, less common than the last in England; does not breed in Holland; *Numenius phæopus* LATH., *Scolopax phæopus* L., NAUM. Taf. 217. These birds are almost all similarly marked, grey-brown above; the tail is white with transverse black bars. The bill of the young bird is much shorter; a species occurs in North America of which the bill is longer than that of the common curlew, *Numenius longirostris* WILS. *Amer. Ornith.* Pl. 64, fig. 4.

Ibidorhynchus VIGORS, GRAY, *Clorhynchus* HODGSON. (Characters nearly of *Numenius*, but feet cursorial, tridactylous. Wings with second and third quills equal, longest.)

Sp. *Ibidorhynchus Struthersii*, VIGORS *Proceed. Zool. Soc.*, Part I. 1830, 1831, p. 174; a species unknown to me, from the Himalayan mountains.

Family VII. *Cultrirostres* CUV. (*Herodii* ILLIG., *Ardeidæ* GRAY). Bill longer than head, thick, strong, mostly compressed, more rarely depressed, broad. Feet tetradactylous, with toes conjoined at the base or semipalmate.

Ibis CUV. (spec. from genus *Tantalus* L., *Numenius* BRISS.). Bill very long, thickened at the base, tetragono-cylindric, arched. Lateral groove produced to the tip of upper mandible. Nostrils basal, placed at the sides of the flattened upper part of bill. Feet elongate, with toes mostly somewhat long, hallux resting. Neck elongate. Wings long, with second quill mostly longest.

This is a numerous genus of which species occur in all the warm countries of the world; they have great resemblance to the preceding genus, but, on the other hand, form the transition to the storks and herons.

Sub-genus: *Falcinellus* BECHST. (*Eudocimus, Tantalides* WAGL., *Ibis* GRAY). Tarsi elongate, covered anteriorly with transverse scutella. Toes long, slender.

Sp. *Ibis viridis* CUV., *Tantalus Falcinellus* L., BUFF. *Pl. enl.* 819, NAUM. Taf. 219; head dark brown, body chestnut-brown below, back and wings dark green with violet reflections; this bird breeds in Asia, North Africa, and in Eastern Europe, migrates also to other parts of Europe, and has been

occasionally observed in Holland and England. A very similar but larger species occurs in Chili and Mexico; *Ibis chalcoptera* TEMM., *Pl. color.* 511. —*Ibis rubra, Tantalus ruber* L., BUFF. *Pl. enl.* 80, 81, CUV. *R. Ani., éd. ill., Ois.* Pl. 78, fig. 3; in South America.

Geronticus WAGL. (add *Cercibis, Phimosus, Theristicus* and *Harpiprion* ejusd.), GRAY. Tarsi robust, covered anteriorly with hexagonal scales. Toes often somewhat short, thick. (Wings with third and fourth quills mostly subequal, longest. Face often unplumed, with a naked space between bill and eyes).

Sp. *Ibis cristata* VIEILL., BUFF. *Pl. enl.* 841, *Dictionn. univ. d'Hist. nat., Ois.* Pl. 9, fig. 2;—*Ibis albicollis, Tantalus albicollis* GM., BUFF. *Pl. enl.* 916, from Chili, &c.; in this species especially the toes are short and at the same time thicker than in the rest of the species.

The most celebrated species is *Ibis religiosa* CUV., SAV., *Geronticus æthiopicus* GRAY, *Ann. du Mus.* IV. 1804, pp. 110—135, Pl. 53, (Pl. 52, the skeleton), BLUMENB. *Abb. naturh. Gegenst.*, No. 86, under the improper name of *Tantalus ibis*, GUÉR. *Iconogr., Ois.* Pl. 55, fig. 1; white, the head and neck naked, bill, feet and ends of primaries and secondaries black; see the accurate description of HERODOTUS, lib. II. c. 76. This is the species, as CUVIER has shewn from his investigation of the mummies of the *Ibis*, to which the Egyptians paid divine honours and which they embalmed, and which is so often figured on their monuments; see also J. C. SAVIGNY, *Hist. nat. et mythologique de l'Ibis.* Paris, 1805, 8vo. Previously another species, more resembling the stork, *Tantalus ibis* L., had been mistaken for it. The opinion of BÉLON, that the *Ibis* of the Egyptians was a stork, has had no adherents[1].

Platalea L. (excl. *Platalea pygmæa*), *Pelecanus* MOEHRING et veterum. Bill elongate, depressed, with tip orbiculate, broad. Nostrils oblong, approximate, placed near the base of bill in a groove on each side, produced alongside the margin. Orbital region denuded. Tarsi reticulate; feet tetradactylous, with toes long, the anterior connected at the base by membrane, the hallux inserted somewhat high, resting. Wings with first three quills subequal, second longest of all. Tail short, even.

Sp. *Platalea leucorodia* L., BUFF. *Pl. enl.* 405, NAUM. Taf. 230; the *white spoonbill, la spatule, der Löffler;* white, with a tuft of elongated feathers at the back of the head; this bird, which, with the exception of the bill,

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1 "*Excepté les apothicaires qui ont pris la cicogne pour emblême, parce qu'ils l'ont confondue avec l'ibis auquel on attribue l'invention des clystères.*" CUVIER *Ann. du Mus.* IV. p. 129; compare the citations there from ancient authors.

much resembles *Ibis religiosa*[1], lives on small fishes, crustaceans, insects, &c., keeps on the shores of rivers, makes its nest usually in trees or thickets, and lays 2 or 3 dull-white eggs. The spoonbill migrates with the stork, and is met with in Holland, especially in the canals of the Biesbosch, about Dordrecht, in numbers.—*Platalea Ajaja* L., BUFF. *Pl. enl.* 165, LESS. *Ornith.* Pl. 99, fig. 1, GUÉR. *Icmogr., Ois.* Pl. 54, fig. 3; in South America and the south of North America. In Japan also a couple of species of this genus are found, one of which is larger than the European. Another species, *Platalea tenuirostris* TEMM., SONNERAT *Voy. à la Nouv. Guinée,* Pl. 51, 52, from the Philippine Islands, is distinguished by red legs.

Balæniceps GOULD. Bill much longer than head, robust, broad; culmen terminating in a powerful hook; tip of lower mandible truncated. Nostrils placed in a narrow slit at the base of bill close to the culmen, scarcely perceptible. Orbits denuded. Skin of throat loose, expansile. Tibiæ and tarsi reticulated. Toes without interdigital membrane, very long; hallux directed inwards. Wings very powerful, the third, fourth, and fifth quills the longest.

Sp. *Balæniceps rex* GOULD, *Proceed. Zool. Soc.* 1851, pp. 1, 2, *Aves,* Pl. XXXV. JARDINE *Contrib. to Ornith.* 1851, pp. 11—13 (figure of the head). Hab. the upper part of the White Nile in Eastern Africa. This remarkable bird is allied to *Cancroma* and *Platalea,* but *Cancroma* has, like the herons, the claw of middle toe strongly pectinated, which is not the case with *Balæniceps* or *Platalea.*

Tantalus L. (in part), CUV. Bill elongate, rounded at the culmen, subcurved, emarginate towards the tip, without nasal groove, with margins drawn in. Nostrils placed near the base, dorsal, longitudinal. Part of head and sometimes throat without feathers. Tarsi reticulate; toes long, anterior conjoined at the base by membrane; hallux resting. Wings with first quill shorter, second and third subequal, third longest of all.

Sp. *Tantalus Ibis* L., BUFF. *Pl. enl.* 389, LESS. *Ornith.* Pl. 99, fig. 1, GUÉRIN *Iconogr., Ois.* Pl. 54, fig. 2; white, wings somewhat rose-red, bill yellow; round the eyes and at the base of the bill the head is bald and red-coloured. This bird is regarded incorrectly by LINNÆUS, BUFFON and others as the *Ibis* of the Egyptians (see above, p. 403); it is met with principally in Senegal.—*Tantalus loculator* L., BUFF. *Pl. enl.* 868, *le couricaca de Cayenne;* Surinam, Brasil, the South of North America, &c.

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[1] That there is a near affinity between *Ibis* and *Platalea* I thought to illustrate also by comparison of the skeleton, but afterwards I found that the celebrated physiologist R. WAGNER, so experienced in the comparative anatomy of birds, had anticipated me; NAUMANN l. l. IX. s. 307.

Anastomus BONNAT., ILLIG., *Hians* LACEP. Bill elongate, porrect, fibrous, rough, emarginate at the tip, compressed, with margins rubbed down, gaping in the middle. Nostrils basal, superior, pervious. Feet elongate, with tibiæ for the greater part naked. Tarsi reticulate. Toes long, anterior joined at the base by membrane; hallux insistent. Wings with second and third quills or third and fourth longest, subequal.

Sp. *Anastomus coromandelicus, Ardea coromandelica* GM. (and *Ardea pondiceriana* GM.), BUFF. *Pl. enl.* 932, SONNERAT *Voy. aux Ind. Or.* Pl. 122; Bengal.—*Anastomus lamelligerus* TEMM. *Pl. color.* 236, GUÉR. *Iconogr., Ois.* Pl. 54, fig. 1; in Senegal and South Africa; black, with glossy, red-brown and violet coverts on the back and wings; the feathers of the neck, breast and belly have the shaft running into smooth, horny lamellæ (*plumæ foliiferæ*), such as present themselves in *Gallus Sonneratii*, in a species of *Ibis* (*Ibis lamellicollis* LAFBEN.), and some also on the wings of *Bombicilla garrulus.*

Ciconia ILLIG. (species of *Ardea* and *Mycteria* L.). Bill elongate, thick, straight, with lower mandible subrecurved. Nostrils linear, placed near the base at the culmen of bill. Region round the orbits destitute of feathers; sometimes the whole face and throat naked. Feet elongate. Tarsi reticulate with hexagonal scales. Anterior toes conjoined at the base by membrane; hallux insistent from the point to beyond the middle. Wings with second and third, or third and fourth quills longest.

Sp. *Ciconia alba* BRISS., *Ardea Ciconia* L., BUFF. *Pl. enl.* 866, LESS. *Ornith.* Pl. 98, fig. 1, NAUM. Taf. 228; the *stork, la cicogne, der Storch;* white, with flag-feathers black, a bald, blackish circle round the eyes; bill and legs red; this bird commonly known in Holland and other parts of the continent, but a rare visitant in England, frequents the banks of rivers, lakes, canals, &c., makes its nest in dead trees, on roofs of houses, especially on towers, and lays 3, 4 or 5 white eggs; it feeds on frogs, grasshoppers, beetles, and even on mice; on account of its destroying injurious animals the stork has been regarded, both in modern and in ancient times (compare PLINIUS *Hist. nat.* Lib. XC. 23) as a sacred bird by the farmer.—*Ciconia nigra* BECHST., *Ardea nigra* L., BUFF. *Pl. enl.* 399, NAUM. Taf. 229; the *black stork, la cicogne noire, der schwarze Storch;* black, with green and purple gloss, bill and legs like the preceding species; this bird makes its nest in trees and lives more on fish, like the heron; it is found in many countries of Europe, but is very rare and accidental in Holland, for it does not appear to make its nest there.—*Ciconia maguari, Ardea maguari* GM., GUÉRIN *Iconogr., Ois.* Pl. 53, fig. 1, in America, especially in Brasil, &c.

Argala LEACH, *Leptoptilus* LESS., GRAY. Bill very large, thick, trigonal. Head and neck unplumed.

Sp. *Ciconia marabu* TEMM., *Pl. col.* 300; from the continent of India, also in Java and Sumatra;—*Ciconia argala* TEMM. *Pl. col.* 301; from Senegal and South Africa. Large species of storks with naked neck, which forms a dependent, elongated sac below; according to TEMMINCK the two species were confounded formerly under the name of *Ardea dubia* or *Ciconia argala*, which names however GRAY adduces as synonyms of the first species. The loose white tail-coverts, *marabou*-feathers, are sold at a high price.

Mycteria L. Bill subascending. Head and neck destitute of feathers.

Sp. *Ciconia mycteria* TEMM., *Mycteria americana* L., BUFF. *Pl. enl.* 817, LESS. *Ornith.* Pl. 98, fig. 2;—*Ciconia ephippiorhyncha* TEMM., *Mycteria senegalensis* LATH., CUV. *R. Ani., éd. ill., Ois.* Pl. 75, fig. 3.

Scopus BRISS., ILLIG. Bill elongate, high at the base, compressed, curved at the tip, excavated by a narrow, deep groove on each side near the culmen. Nostrils placed near the base of bill below the groove, narrow, linear. Face plumed. Tarsi reticulate in front. Anterior toes joined at the base by membrane; hallux insistent. Wings with first quill short, second, third, and fourth subequal, third longest of all. Tail short.

Sp. *Scopus umbretta* GM., BUFF. *Pl. enl.* 798, LESS. *Ornith.* Pl. 69, fig. 1, GUÉR. *Iconogr., Ois.* Pl. 53, fig. 3, hab. in Africa.

Cancroma L. Bill long, depressed, broad, carinate above, with tip narrowed, curved. Nostrils basal, approximate; groove extending on each side of culmen from the nostrils to the tip. Tarsi covered anteriorly with large, broad, hexagonal scales. Claw of middle toe incised pectinately on the inside. Anterior toes united at the base; hallux insistent, inserted on the internal side of lower part of tarsus. Wings with first quill shorter, the next increasing up to the fourth, fourth and fifth subequal, longest.

Sp. *Cancroma cochlearia* (and *Cancroma cancrophaga*) L., BUFF. *Pl. enl.* 38, 896, LESS. *Ornith.* Pl. 97, fig. 2, GUÉR. *Iconogr., Ois.* Pl. 52. fig. 1; the *boat-bill, le savacou;* in Surinam and other parts of South America; this bird lives on fish, like the herons, from which it differs by the flat bill, which, according to the comparison of BUFFON, has the form of two spoons lying one upon the other with the convex surface upwards. It is generally supposed that there is only one species known, and that the red-brown specimens are young birds; not long ago, however, it was asserted on the contrary by a French voyager, E. DEVILLE, that there exist different species of *Cancroma*, GUÉRIN *Revue et Magasin de Zool.* 1852, p. 225.

Ardea L. (in part), CUV., ILLIG., TEMM. Bill elongate, straight, thick, compressed, acuminate, furnished with a groove from the nostrils evanescent towards the tip. Nostrils placed near the base of bill, covered by membrane posteriorly. Tarsi mostly scutellate in front, elongate. Outer toes connected by membrane. Hallux insistent, inserted internally at the lower part of tarsus. Claw of middle toe with inner margin produced, incised pectinately. Wings moderate, with first quill mostly shorter, the three following subequal, second and third, or third and fourth, longest of all.

The species of the genus of the *Herons* are very numerous in both hemispheres of the world. They live in marshy regions, or on the banks of rivers and lakes, and feed chiefly on fish, also on frogs and their larvæ, and on water-insects; they watch long for their prey and then shoot out their long neck as swift as a dart to seize it. They build their nest partly in trees, partly amongst reeds, lay light blue, sea-green or greenish eggs (3 or 4, some species occasionally 5), and moult once a year. There is little difference between the two sexes. Some species are scattered over a large part of the world.

Nycticorax STEPH., GRAY. Feet moderate. Tarsi reticulate anteriorly with large, hexagonal scales. Occiput crested or feathered with pendent plumes. Bill moderate or scarcely longer than head, with culmen curved. Wings with third quill longest.

Sp. *Ardea Nycticorax* L., BUFF. *Pl. enl.* 758, NAUM. Taf. 225; the *night-heron, le Bihoreau, der Nachtreiher;* very common in many countries of Europe, in Africa, also in Asia and in Japan.—In America a closely allied species or local variety occurs, *Ardea Gardeni* GM., of which a young specimen is figured in BUFF. *Pl. enl.* 939.—*Ardea caledonica* GM., CUV. *R. Ani., éd. ill., Ois.* Pl. 74, fig. 2, Australia, Celebes, Timor, &c.

Tigrisoma SWAINS., GRAY. Feet elongate; tarsi reticulate anteriorly with hexagonal scales. Bill subulate, elongate. Wings with first quill short, third and fourth subequal, longest of all.

Sp. *Ardea lineata* GMEL., BUFF. *Pl. enl.* 860, South America, Cayenne, &c.

Ardea of modern authors (*Herodias, Ardeola, Buphus* BOIE). Feet elongate; tarsi scutellate anteriorly. Bill elongate, subulate. Wings with first four quills subequal, second and third longest of all. Neck elongate, slender.

Sp. *Ardea cinerea* (and *major*) L., BUFF. *Pl. enl.* 755 (adult), 787 (younger), LESS. *Ornith.* Pl. 97, fig. 1, NAUM. Taf. 220; the *common heron, le héron commun, der graue Reiher;* the largest European species, bluish-grey above, white below; black spots along the neck. These herons build their nests in large societies. The same species is found at Java, in Japan, and at the Cape of Good Hope.—*Ardea purpurea* L., BUFF. *Pl. enl.* 788,

NAUM. Taf. 221; smaller than the preceding, with grey wings, red-brown neck, with a longitudinal black band and very long toes; this species also occurs in Java, a very rare visitant in England;—*Ardea agami* GM., GUÉR. *Iconogr., Ois.* Pl. 52, fig. 2, in South America, &c. This group of the herons is richest in species.—Some entirely white species are remarkable; they have long waving feathers, light but stiff, on the back above the tail, which are used as ornaments for the head, especially in Hungary, where they form part of the national costume. Sp. *Ardea egretta* GM., BUFF. *Pl. enl.* 925, NAUM. Taf. 222, with yellow bill, sometimes black at the tip,—and a much smaller species, *Ardea garzetta* L., NAUM. Taf. 223, with black bill. Exotic species also are known of this group, which, on account of their resemblance to the species here noted, have been confounded with them; comp. TEMMINCK *Manuel*, II. p. 572—576, IV. p. 372—380.

Botaurus STEPH., GRAY. Feet moderate, thick, with tibiæ plumed throughout the greater part. Tarsi scutellate anteriorly. Toes very long. Bill moderate or scarcely longer than head, subulate. Neck densely feathered. Wings with first three quills subequal, the second longest of all.

Sp. *Ardea stellaris* L., BUFF. *Pl. enl.* 789, NAUM. Taf. 226; the *common bittern, le butor, der Rohrdommel;* colour of feathers as in the woodcock and some owls; is, like these, a night-bird; it builds an inartistic nest in the sedge, and emits a loud sound that resembles the bellowing of an ox.

Aramus VIEILL., TEMM., *Notherodius* WAGL. Bill long, compressed, with tip curved, protracted beyond the lower mandible. Nostrils lateral, placed in groove, pervious. Feet elongate, slender; tarsi covered anteriorly with large transverse scutella. Toes long, scarcely united at the base. Hallux raised, resting on its point. Neck elongate. Wings with first quill short, third and fourth subequal, longest of all. Tail moderate, rounded.

Sp. *Aramus scolopaceus, Ardea scolopacea* GM., *Rallus gigas* LICHTENST.; BUFF. *Pl. enl.* 848; South America, Cayenne; brown, with round, white spots on the neck; legs black. This genus is very nearly allied to the following.

Eurypyga ILLIG., *Helias* VIEILL. Bill elongate, compressed, subulate, emarginate at the tip. Nostrils placed in a deep, lateral groove, linear. Tarsi covered anteriorly with scutella; outer toes conjoined at the base; hallux insistent; claws compressed, curved, moderate. Neck long, slender. Wings with first quill shorter, third, fourth, and fifth subequal, longest of all. Tail long, broad.

Sp. *Eurypyga helias, Ardea helias* GM., *Helias phalænoides* VIEILL., BUFF. *Pl. enl.* 782, LESS. *Ornith.* Pl. 102, fig. 2, CUV. *R. Ani., éd. ill., Ois.* Pl. 72, fig. 2; in South America; regarded incorrectly by LATHAM as a species of snipe, closely allied, on the contrary, to *Ardea*. Within the last few years a very similar species from Columbia has become known.

Grus PALL., (excl. *Psophia* ILLIG., species of *Ardea* L.). Bill moderate or elongate, somewhat thick, straight, compressed, with tip subulate, mandibles subequal. Nostrils pervious, closed posteriorly by membrane, placed nearly at the middle of bill in a groove broad, deep, not produced to the tip of bill. Region about the base of bill and orbits often unplumed or warty. Feet elongate; tibiæ in great part denuded; tarsi scutellate anteriorly. Toes short, strong; outer joined at the base by membrane; hallux short, raised, or resting on the point only. Wings moderate, with quills increasing from first to third, third longest of all.

Sp. *Grus cinerea* BECHST., *Ardea grus* L., BUFF. *Pl. enl.* 769, NAUM. Taf. 231, the *crane, la grue, der Kranich;* dwells during the summer in the high north and in the east of Europe; migrates in large troops, formed into a triangle; their passage over the Mediterranean sea attracted the notice of the ancients, whose writings often make mention of it;—*Grus numidica* BRISS., *Ardea virgo* L., BUFF. *Pl. enl.* 241, NAUM. Taf. 232;—*Grus carunculata, Ardea carunculata* LATH., GUÉR. *Iconogr., Ois.* Pl. 51, fig. 3, GRAY *Gen. of Birds,* Pl. CXLVIII.; Africa.—The *crowned bird* of Africa, *Grus pavonina, Ardea pavonina* L., EDWARDS *Birds,* Tab. 192, *Dictionn. univ. d'Hist. nat., Ois.* Pl. 9, fig. 2, has a much shorter bill than the other species, as also distinguished from this in later times but very similar, *Grus regulorum* LICHTENST.[1] from South Africa, BUFF. *Pl. enl.* 265. These crested cranes form the genus *Balearica* of BRISSON and GRAY.

Psophia L. Bill shorter than head, curved, vaulted. Nostrils placed in the middle of bill in a broad groove, pervious. Feet elongate, with tarsi long, scutellate anteriorly. Hallux resting on point; toes moderate, strong, outer conjoined at the base by membrane. Wings short, with first quill short, fourth and fifth subequal, longest of all. Tail very short.

Sp. *Psophia crepitans* L., *Grus psophia* PALL., BUFF. *Pl. enl.* 169, PALLAS *Spic. Zool.* IV. Tab. 1; A. VOSMAER *Beschrijving van den Amerikaanschen trompetter,* Amsterdam, 1768, with a coloured figure, LESS. *Ornith.* Pl. 91, fig. 1, CUV., *R. Ani., éd. ill., Ois.* Pl. 71, fig. 2; the *Agami* or *caracara,* from Surinam and other countries of tropical South America. This bird is very tame; it emits a peculiar dull sound, somewhat resembling the cooing of doves, which seems to proceed from an air-sac. They bear some resemblance to the gallinaceous birds, with which BUFFON united them, in the short arched bill and the external appearance. Within the last few years two very similar species, also from S. America, have been made known.

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[1] See on both species *Proceed. of the Zool. Society,* Part I. 1833, p. 118, the report of the secretary (E. T. BENNETT).

Dicholophus ILLIG., *Cariama* BRISS., GRAY, *Microdactylus* GEOFFR. Bill moderate, parted as far as below the eyes, with upper mandible longer, convex and curved, subvaulted. Nostrils nearer to the base of bill, covered by membrane, opening by aperture anterior, oblong. Feet elongate; tarsi covered with large transverse scutella; toes very short, anterior conjoined at the base; hallux raised. Wings moderate, with first quill short, fifth and sixth subequal, longest of all. Tail long, broad.

Sp. *Dicholophus cristatus, Palamedea cristata* L., TEMMINCK *Pl. col.* 237, GUÉR. *Iconogr., Ois.* Pl. 51, fig. 1, MAXIM. *Abb. zur Naturgesch. Bras., Aves,* Tab. IV.; the *Sariama* or *Seriema;* this bird is met with over a large extent of South America, from the 8th to the 31st degree of S. L.; it has a double row of erect, thin feathers on the head. Compare on this bird GEOFFROY SAINT-HILAIRE, *Ann. du Mus.* XIII. pp. 362—370, Pl. 26, and *Prinz* MAXIMILIAN *zu* WIED NEU-WIED, *Nov. Act. Acad. Cæs. Leop. Carol.* Tom. XI. pp. 341—350. (Where there is a figure of the head, natural size.)

Genus anomalous, swan-like. *Phœnicopterus.*

Phœnicopterus L. Bill high at the base, broken and curved, with margins lamellate and dentate. Nostrils longitudinal, pervious, covered above by membrane. Neck very long. Feet very long, palmate; tarsi covered anteriorly with transverse scutella. Hallux short, raised. Wings moderate, with first and second quills subequal, longest of all.

Sp. *Phœnicopterus antiquorum* TEMM., (*Phœnicopterus ruber* L. in part), BUFF. *Pl. enl.* 63, NAUM. Taf. 233; the *flamingo, le flammant;* in Asia, Africa and the South of Europe, especially in Sicily and Sardinia; rose-coloured, with red wings and black flag-feathers; 3 or 4 feet high. This bird builds a pyramidal nest and sits on it as on a saddle, with the legs hanging down by the sides. The fleshy tongue of the flamingo was amongst the exquisite delicacies of the extragavant Romans. Formerly this species was not distinguished from the American, to which TEMMINCK would appropriate exclusively the name of *Phœnicopterus ruber.* There is in South America also *Phœnicopterus ignipalliatus* IS. GEOFFROY and D'ORBIGNY, GUÉRIN *Magas. de Zool.* 1832, *Ois.* Pl. 2, GUÉR. *Iconogr., Ois.* Pl. 59, fig. 2, with shorter legs, and the bill, from the tip to more than half, black, and in Africa a species much smaller than the preceding three, occurring also at the Cape of Good Hope and elsewhere: *Phœnicopterus minor* TEMM. *Pl. col.* 419.

Family VIII. *Pressirostres* (*Charadriadæ* VIGORS, GRAY). Bill moderate, seldom longer than head, with tip protracted, hard, com-

pressed, somewhat tumid behind the nostrils. Feet elongate; toes somewhat short, almost always connected at the base by membrane; hallux in some resting on the point only, in many none.

Dromas PAYKULL. Bill elongate, strong, compressed, with culmen curved towards the tip. Nostrils oval, lateral, pervious. Neck short. Feet tetradactylous, semipalmate; with hallux resting on the point. Tarsi covered anteriorly with large, transverse scutella. Wings pointed, with first quill longest of all.

Sp. *Dromas ardeola* PAYK., *Erodia amphilensis* STANLEY in SALT *Voyage to Abyssinia*, London, 1814, Appendix IV. p. lxii. Pl. opposite to it, DUPONT *Ann. des Sc. nat.* IX. pp. 184—187, Pl. 45 (male), TEMM. *Pl. col.* 362 (fem.), CUV. *R. Ani., éd. ill., Ois.* Pl. 77, fig. 2; of the size of the Avocet, white, back, flag-feathers and bill black; this bird lives in Arabia and Bengal. This genus, which we place here provisionally, is usually arranged, incorrectly as it seems to us, close by *Ciconia*.

Hæmatopus L. Bill elongate, straight, compressed, with tip cuneate, obtuse. Nostrils linear, placed in lateral groove near the base of bill. Feet moderate, cursorial, with toes conjoined at the base by membrane, that of the inner toe very short. Tarsi reticulate. Wings long, with first quill longest of all.

Sp. *Hæmatopus ostralegus* L., BUFF. *Pl. enl.* 929, LESSON *Ornith.* Pl. 95, fig. 2, NAUM. Taf. 181; the *pied oyster-catcher;* black, with a white bar on the wings, belly and base of the tail white, bill and legs red. Numerous in the summer on our coasts, where it makes its nest on the bare ground above high-water mark.—*Hæmatopus palliatus* TEMM., GUÉR. *Iconogr., Ois.* Pl. 50, fig. 2, from America, &c.

Chionis FORST.[1], *Vaginalis* LATH. Bill shorter than head, somewhat thick, subconical, compressed, surrounded at the base by a horny sheath. Nostrils placed in middle of bill, at the margin of the horny sheath. Feet moderate, with tibiæ feathered nearly to the joint, with tarsi reticulately scaly. Outer toes conjoined at the base by membrane; hallux raised, insistent at the point. Wings moderate, tuberculate, with first and second quills subequal, longest of all.

Sp. *Chionis alba* FORST., LATHAM *Synops.* III. Pl. 80, FREYCINET *Voy. aut. du monde, Zool.* VI. Pl. 35, TEMM. *Pl. col.* 509, LESS. *Ornith.* Pl. 109, fig. 2, in New Holland;—*Chionis minor* HARTL., GRAY *Gen. of Birds*, Pl. CXXXVI. This genus is by some writers placed amongst the gallinaceous birds.

[1] J. R. FORSTER, *Enchiridion historiæ naturali inserviens.* Halæ, 1788, 8vo, p. 37.

Glareola BRISS. Bill short, curved, compressed at the tip, with gape produced behind the base under the eyes. Nostrils placed at the base of bill. Tarsi covered anteriorly with transverse scutella. Toes short, anterior conjoined at the base by membrane, middle toe much larger than the subequal lateral toes, with claw elongate, acute. Hallux raised. Wings long, pointed, with first quill longest of all. Tail in some forked, in some emarginate.

Sp. *Glareola pratincola* LEACH, *Hirundo pratincola* L., *Glareola austriaca* GM., *Glareola torquata* MEYER, TEMM., BRISS. *Ornith.* v. Pl. 12, fig. 1, BUFF. *Pl. enl.* 882, NAUM. Taf. 234, the *collared pratincole, perdrix de mer, Sandhuhn;* this bird lives in Asia, Africa, and the south, especially the south-east, of Europe, on the banks of rivers and great lakes; the bill fissured as far as below the eyes, recalls the swallows, with which, as also with *Sterna*, this genus corresponds in the long, pointed wings. This bird feeds on beetles, grasshoppers, &c.—*Glareola lactea* TEMM., *Pl. color.* 399, GUÉR. *Iconogr., Ois.* Pl. 59, fig. 1; on the banks of the Ganges, smaller than the preceding;—*Glareola grallaria* TEMM., from Australia, New Guinea and Borneo, has the bill stronger and longer, and much higher legs than the preceding species, and approaches the following nearly allied genus.

Cursorius LATH., (*Tachydromus* ILLIG., a name already given to a genus of reptiles by DAUDIN.) Bill shorter than head, cloven to below the eyes, curved. Nostrils placed in an excavation at the base of bill, lateral, pervious. Feet elongate, cursorial; outer toes joined at the base; tarsi covered anteriorly and posteriorly with transverse scutella. Wings moderate, with first two quills mostly subequal, first quill longest of all. Tail rounded.

a) *With first two quills of wings longest of all.*

Sp. *Cursorius isabellinus* MEYER, *Cursorius europœus* LATH., *Charadrius gallicus* GM., BUFF. *Pl. enl.* 795; North Africa, sometimes, but rarely, seen in Europe;—*Cursorius coromandelicus, Cursorius asiaticus* LATH., *Charadrius coromandelicus* GM., BUFF. *Pl. enl.* 892, GUÉR. *Iconogr., Ois.* Pl. 50, fig. 3, &c.

b) *With first quill of wings short, second and third longest of all.*

Sp. *Cursorius chalcopterus* TEMM. *Pl. color.* 298, GRAY *Genera,* Pl. CXLIII. Senegal. This entire genus is peculiar to the continent of the eastern hemisphere.

Oreophilus JARDINE and SELBY.

Note.—Genus unknown to me, related to the preceding. Sp. *Oreophilus totanirostris* from the Falkland Islands.

Pluvianus VIEILL.; GRAY, *Ammoptila* SWAINS. Bill shorter than head, strong, curved from the culmen towards the tip. (Feet as in *Cursorius*, but tarsi longer.) Wings with second quill longest.

Sp. *Cursorius charadroïdes* WAGL., *Pluvianus ægyptius* GRAY, *Charadrius melanocephalus* LATH., BUFF. *Pl. enl.* 918, *Dict. univ. d'Hist. nat.*, *Ois.* Pl. 22, fig. 1; Egypt. It is related that this bird seeks for insects, especially gnats, in the mouth of crocodiles, which is always open when these animals bask in the sun; it is perhaps the τρόχιλος of HERODOTUS, II. 68, which keeps the crocodile's mouth clear of leeches?

Œdicnemus TEMM. (spec. of *Charadrius* L., ILLIG.). Bill moderate (or longer than head), strong; lower mandible ascending to the tip from the rather prominent angle. Nostrils placed in a depression of bill, longitudinal, opening anteriorly, pervious. Feet elongate, cursorial, with tarsi reticulate. Toes conjoined at the base by membrane, the lateral toes short, the middle somewhat long. Wings with first quills subequal, the first longest of all. Tail long, cuneate.

Sp. *Œdicnemus crepitans* TEMM., *Charadrius Œdicnemus* L., BUFF. *Pl. enl.* 919, NAUM. Taf. 172; the *common thick-knee;* principally in Southern Europe, North Africa and Western Asia; rare with us. The young birds have the tarsi much enlarged at the bend of the feet.—*Œdicnemus grallarius*, *Œdicnemus longipes* GEOFFR., *Pl. color.* 386, LESS. *Ornith.* Pl. 94, fig. 2; New Holland.—In some species the bill is longer than the head: *Œdicnemus magnirostris* GEOFFR., TEMM. *Pl. col.* 387; Celebes, New Guinea, and *Œdicnemus recurvirostris*, Mus. Paris., GRAY *Gen. of Birds*, Pl. CXLII.; from Bengal; in this last species the bill is curved upwards. It forms the genus *Esacus* of LESSON.

Charadrius L. (excl. of many species), TEMM. Bill shorter than head, tumid behind the nostrils, subulate. Nostrils linear, perforated in membrane covering the groove of mandible. Feet moderate, cursorial; outer toes conjoined at the base by membrane. Tarsi reticulate with scales. Wings moderate, with first two quills subequal, the first mostly longest of all. Tail rounded or even.

Sp. *Charadrius pluvialis* L. (and *Ch. apricarius* ejusd.), BUFF. *Pl. enl.* 904, NAUM. Taf. 173, CUV. *R. Ani.*, *éd. ill.*, *Ois.* Pl. 69, fig. 2; the *golden plover, der Gold-Regenpfeifer;* black above, with yellow spots; in the summer plumage neck and breast deep black. This species lays in a hole on the ground four or three, very large, yellow-green, spotted with brown, smooth eggs.—*Charadrius morinellus* L., BUFF. *Pl. enl.* 832, NAUM. Taf. 174, the *dotterel plover;* brownish, a white band behind the eyes; in the

adult bird a white band above the breast. In some small European species the summer plumage does not differ from that of winter, or they moult only once a year; *Charadrius hiaticula* L., BUFF. *Pl. enl.* 920, LESS. *Ornith.* Pl. 93, fig. 1, the *ringed plover*, occasionally on the Dutch coast, as also *Charadrius minor*, the *little ringed plover;* in England the former species is common, the last very rare.

This genus, though forming a part only of that of LINNÆUS, is very numerous in species from all parts of the world.

Hoplopterus BONAP. Wings spurred, with second and third quills longest.

Sp. *Charadrius spinosus* L., under which name two species have been confounded, both from Africa; the largest of the two, BUFF. *Pl. enl.* 801, is *Vanellus melasomus* SWAINSON, *Birds of Western Africa*, II. 1837, Pl. 26.

Squatarola CUV., GRAY. (species of *Tringa* L., ILLIG.). Bill moderate, thick. Feet tetradactylous; hallux short or very short, raised. (Other characters nearly those of the preceding genus. Add genus *Aphriza* AUDUB., GRAY.)

Sp. *Squatarola varia* nob., *Tringa squatarola*, *Tringa helvetica* and *Tringa varia* L., *Charadrius squatarola* NAUM., BRISS. *Ornith.* V. Pl. 9, figs. 1, 2, BUFF. *Pl. enl.* 853, 854, 923, NAUM. Taf. 178; *grey plover, grey sandpiper;* white, brown and black spots; the summer plumage is, in the male especially, deep black under the neck, on the breast and the belly. Some writers refer this species to *Charadrius*, but most to *Vanellus;* it belongs, however, to neither of these two, but stands in some degree between them, nearest in our opinion to *Charadrius*. It occurs in Europe, Africa (to the Cape of Good Hope) and Asia, and is also met with in North America.

Vanellus BRISS., BECHST., TEMM., CUV. (*Tringa* ILL., excl. *Tringa varia;* species of *Tringa* L.) Bill slender, straight, shorter than head. Nostrils placed in lateral groove, covered by membrane, opening by a longitudinal fissure. Feet tetradactylous, with hallux small, raised; tarsi covered anteriorly with transverse scutella; outer toes joined at base by membrane. Wings with first quill shorter, second and third subequal, longest of all. Tail even, broad.

Sp. *Vanellus cristatus* MEYER and WOLF, *Tringa vanellus* L., BUFF. *Pl. enl.* 242, LESS. *Ornith.* Pl. 95, fig. 1, NAUM. Taf. 179; the *pœwit, le vanneau, der Kibitz* (the English and German names borrowed from the note of the bird, which BUFFON compares with the French word *dix-huit*). This bird eats worms and insects, and lays three or four olive-coloured eggs, with black spots, and sharp pointed, on the ground, on a layer of straw or fibres of roots; the eggs are much prized. This bird occurs in Europe, North Africa, and a part of Asia.

In some exotic species the wings are spurred and the bill has sometimes lobed appendages. Sp. *Vanellus goënsis, Parra goënsis* GM., BUFF. *Pl. enl.* 807;—*Vanellus senegallus, Parra senegalla* L., BUFF. *Pl. enl.* 362, *Vanellus cucullatus,* TEMM. *Pl. col.* 505, &c. They form the genus *Lobivanellus* STRICKLAND, *Chettusia* BONAP., GRAY.

Strepsilas ILLIG., *Cinclus* MOEHR., GRAY. Bill moderate, subulate, acute, subascending. Nostrils basal, lateral, half covered above by membrane, pervious. Feet moderate, with toes short, the anterior cloven; hallux raised, resting on the point. Tarsi scutellate anteriorly. Wings long, with first quill longest of all. Tail truncated or rounded, moderate.

Sp. *Strepsilas collaris* TEMM., *Tringa interpres* L., BUFF. *Pl. enl.* 856, LESSON *Ornith.* Pl. 94, fig. 1, NAUM. Taf. 180; the *common turnstone, la tourne pierre, der Steinwälzer;* so named because it turns over the stones with its bill in search of worms and insects; this species lives in the northern parts of both hemispheres and visits our coasts.

Family IX. *Otides* (*Otidinæ* BONAP.). Bill moderate or short, broad at the base, curved at the tip. Feet cursorial, tridactylous, with toes very short, joined at the base, with tarsi reticulately scaled. Claws broad, obtuse. Wings moderate. (Large birds, related to the *gallinæ*, inhabitants of the old world.)

Otis L. Bill moderate or short, with upper mandible vaulted towards the tip. Nostrils placed in lateral groove, half covered by membrane, pervious. Wings with first quill shorter, second, third, and fourth subequal, fourth longest of all. Tail long, broad (quill-feathers mostly 20).

See on this genus E. RUEPPELL *Monographie der Gattung Otis, Museum Senckenbergianum,* II. Frankf. a. M. 1837, pp. 205—248, Tab. XIII.—XV.; compare TEMMINCK *Pl. color.* V. (texte de la 102 livraison).

The *bustards* are large birds of the eastern hemisphere, the greater number of species of which are found in Africa. However much they resemble *Œdicnemus* and still more *Cursorius*, I conceive that they ought to be regarded as a distinct family, which forms the transition to the gallinaceous birds. They are not migratory birds, but stragglers, and live mostly in society on corn-fields and widely extended plains. Their food consists of green parts of plants, seeds, insects, and especially of beetles and worms.

a) *With bill compressed, short. Otis* LESSON, GRAY.

Sp. *Otis tarda* L., BUFF. *Pl. enl.* 245, LESS. *Ornith.* Pl. 93, fig. 1, NAUM. Taf. 167, 168; the *bustard, l'outarde, der Trappe;* head and neck light grey; back red-brown with black spots; in some parts of Europe, especially

in Thuringia, in Silesia, in the south of Russia and Siberia; with us only rarely; in old times, as it seems, it was more common.

Otis tetrax L., BUFF. *Pl. enl.* 25 male, 10 fem., NAUM. Taf. 169; South of Europe, Tartary, North Africa; an instance of the occurrence of this species in North Brabant is known.

b) *With bill moderate, broad at the base, depressed. Eupodotis* LESS. (add. *Chlamydotis* and *Sypheotis* ejusd.), GRAY.

Sp. *Otis aurita* LATH., TEMM. *Pl. color.* 533; from the continent of India; the adult male has on each side of the head three long curved shafts of feathers, which bear a vane at the extremity only;—*Otis senegalensis* VIEILL., *Otis Rhaad* RUEPP. l. l. Tab. 15;—*Otis houbara* GM., *Psophia undulata* JACQUIN; *Beiträge zur Gesch. der Vögel*, Wien, 1784, Tab. 9, NAUM. Tab. 170;—*Otis caffra* LICHTENST., *Otis ruficollis*, GUÉR. *Iconogr. Ois.* Pl. 49, fig. 1, &c.

Family X. *Proceri* ILLIG. (*Struthionidæ* VIGORS). Wings without quill-feathers, unfit for flying. Feathers of body loose. Bill of various shape, mostly depressed, with culmen distinct; upper mandible with tip produced beyond the lower.

The *struthious birds* are birds of large size, of warm countries, living upon vegetable food. Since they are not able to fly they have the breast-bone less developed than in other birds, and the projecting keel on the forepart is wanting, to which in other birds the pectoral muscles are attached.

Section I. *Apterygineæ.* Feet tetradactylous, with hallux short, raised.

Apteryx SHAW. Bill long, slender, with culmen depressed, tip subclavate, obtuse. Nostrils placed near the tip of bill at the inferior part of lateral groove. Wings very small, concealed under the coverts. Tail inconspicuous. Tarsi thick, reticulate with irregular, unequal scales, broader in the anterior row, transverse. Anterior toes thick, rather long, with claws strong, curved, fossorial. Internal rudiment of hallux resembling a spur.

Sp. *Apteryx australis* SHAW, *Naturalist's Miscellany*, XXIV. Pl. 1057, 1058, YARRELL in *Transact. of the Zool. Soc.* I. pp. 71—76, Pl. 10, GRAY *Gen. of Birds*, Pl. CLXXIX; from New Zealand; lives chiefly amongst high and close ferns and feeds on insects and worms. See on the anatomical peculiarities of this strange bird OWEN *Zool. Transact.* II. pp. 257—301, Pl. 47—55.—*Apteryx Oweni* GOULD, ibid. Vol. III. 1848, pp. 379, 380, Pl. 57.

Section II. *Struthiones.* Feet cursorial, tridactylous, or didactylous.

Casuarius BRISS., LATH., ILLIG. Wings very small, latent, or naked quills. Feathers double, narrow, lax. Feet tridactylous. Tail inconspicuous.

a) *With bill depressed.*

Dromaius VIEILLOT. Nostrils placed in a broad groove, opening at the anterior part of bill. Wings concealed under the plumes.

Sp. *Casuarius Novæ Hollandiæ* LATH., WHITE *Voyage to New South Wales*, Pl. 1. p. 129, PÉRON *Voyage aux terres austr.* Atl. Pl. 36. See the skeleton figured in P. J. DE FREMERY *Specimen Zoolog. sistens observationes de Casuario Nov. Holl.* Traj. ad Rhen. 1819, 8vo.

b) *With bill compressed.*

Casuarius (recentiorum). Nostrils in the middle of bill. Wings of five naked quills.

Sp. *Casuarius galeatus* VIEILL., *Casuarius emeu* LATH., *Struthio casuarius* L., BUFF. *Pl. enl.* 313, *Ménagerie du Mus. national d'Hist. nat.* Paris, 1801, folio, Livr. 1. ed. 8vo, 1. pp. 42—54 (with a very beautiful figure), LESSON *Ornith.* Pl. 2, fig. 1, GUÉRIN *Iconogr., Ois.* Pl. 48, fig. 2; the *casuary* (the Malay name of the bird); on the head is a tubercle, covered with a horny envelop; the head and neck are in part naked, with warty swellings; the feathers are black. This bird inhabits the Moluccan islands and New Guinea, and was first brought alive to Europe by the Dutch.

Struthio L. (excl. *Struthio casuarius*), CUV. Wings unfit for flying, plumed. Bill depressed. Feet tridactylous or didactylous. Tail moderate, with lax plumes.

a) *Feet tridactylous.*

Rhea MOEHR., GRAY. (Genus of the new world.)

Sp. *Struthio rhea* L., LATHAM *Suppl.* II. p. 292, Pl. 137, HAMMER *Ann. du Mus.* XII. 1808, pp. 427—433, CUV. *R. Ani., éd. ill., Ois.* Pl. 67, fig. 2; in the south of South America. A second smaller species was discovered in Chili a few years ago by DARWIN and D'ORBIGNY, *Rhea Darwini* GOULD, *Rhea pennata* D'ORB. *Proceed. of the Zool. Soc.* 1837, p. 35, GRAY *Gen. of Birds*, Pl. CXXXVIII.

b) *Feet didactylous.*

Struthio (recentiorum).

Sp. *Struthio Camelus* L., BUFF. *Pl. enl.* 457, *Ménagerie du Mus. nat.* Livr. 1. (ed. 8vo, 1. pp. 69—82), with a good figure, LESS. *Ornith.* Pl. 1. fig. 1, GUÉRIN *Iconogr., Ois.* Pl. 48, fig. 1; the *ostrich;* in Africa and Arabia;

this bird surpasses all species now living in size, and was known in most ancient times (Job xxxix. 13—18); it runs with great speed against the wind, and lives together in troops, which on the heights are sometimes very numerous, but on the plains, and especially during the breeding season, only consist of four or five in company, namely a cock and the rest hens. These hens living in society lay their eggs in the same nest, or rather in a round hole on the ground. Around it they raise with their feet a kind of mound, against which the outer circle of their eggs rests. They continue to lay until the hole is full, which requires eighty eggs. After this they still lay a few eggs round the nest, as food for the young birds, when they have left the shell. The old birds themselves break the eggs for them one after the other, and with this nutritious supply soon bring them so forward, that they are in a condition to seek their food abroad for themselves. By day the females relieve one another in brooding, or perhaps desert the nest and leave the eggs to the sun's warmth. By night the male broods and wards off the jackals and other beasts of prey that are in eager search for the eggs. An ostrich-egg commonly weighs three pounds, and is considered to equal twenty-four hen's eggs. (LICHTENSTEIN'S *Reisen im südl. Africa*, II. s. 41—45.)

To this family also are referred the bones of large extinct birds from New Zealand, which belong to different species, of which some had three toes, others four, like *Apteryx*. OWEN distinguishes the following two genera of them, *Dinornis* and *Palapteryx*, to which he has since added *Aptornis*, also with four toes.

Compare OWEN *Transact. of the Zool. Soc.* III. pp. 22—32, Pl. 3 (1842), pp. 235—273, Pl. 18—30 (1845), pp. 307—338, Pl. 38—50, pp. 345—372, Pl. 52—56 (1849), IV. pp. 1—20, Pl. 1—4 (1850), pp. 59—68, Pl. 23, 24 (1852).

Amongst the natives there are traditions of large birds, and some voyagers think it not improbable that these birds are not entirely extinct. The bones are certainly of very recent origin; they are found in alluvial soil and in the beds of rivers.

Family XI. *Alectorides* s. *Palamedeinæ*. Bill short, somewhat thick, vaulted, compressed, with tip of upper mandible bent, produced beyond the lower. Nostrils oval, pervious. Tarsi thick, reticulate with hexagonal scales. Feet tetradactylous, with toes strong, long, the anterior conjoined at the base by membrane, and hallux insistent. Wings double-spurred.

Palamedea L. (Characters of the family those of the single genus. Wings ample, with first two quills shorter, third and fourth longest of all.)

Although these birds have on the one hand a conformity with *Psophia* and *Dicholophus*, on the other with *Parra* and still more

with *Tribonyx* (p. 394), yet they are distinguished by their long toes from the two first-named genera, and from the last-named by their tarsi beset with hexagonal horny scales. They have also the breast by no means so compressed as in the *Macrodactyli*, but a powerful form of body. They are large birds of South America, feeding on herbs and the seeds of plants, and forming the transition to the gallinaceous birds.

a) *With the region between the base of bill and the orbits unplumed.*

Chauna ILLIG., GRAY, *Opistolophus* VIEILL.

Sp. *Palamedea chavaria* TEMM., *Parra Chavaria* L., TEMM. *Pl. color.* 219, GUÉR. *Iconogr., Ois.* Pl. 57, fig. 3; this bird, called *Chauna* from its note, is tamed and left to walk with troops of hens and geese, which it protects.—*Parra Derbiana, Chauna Derbiana* GRAY, *Gen. of Birds,* CLXI.; Columbia. Both species have a tuft of long feathers at the back of the head.

b) *With the region between the base of the bill and the orbits plumed.*

Palamedea L., ILLIG., GRAY.

Sp. *Palamedea cornuta* L., BUFF. *Pl. enl.* 45, LESS. *Ornith.* Pl. 92, fig. 1; in Brasil and Guiana; this bird has a long and thin horn on its head in front, but no tuft of feathers.

ORDER III. *Gallinæ* (L.) s. *Rasores.*

Feet covered with feathers as far as the tarsal joint, tetradactylous, more rarely tridactylous, with tarsi covered anteriorly mostly by a double row of transverse scutes. Anterior toes almost always united at the base by membrane; middle toe much longer than the lateral (which are often subequal). Claws moderate, somewhat blunt, grooved below. Bill moderate or short, with culmen convex or gibbous; upper mandible with margin deflected, overlapping the lower. Wings mostly short, rounded. Tail with mostly more than twelve feathers.

Gallinaceous birds.—The breast-bone is truncated in front, forms a narrow bony band on each side of the keel, and is besides, in great part, represented by membrane, with a forked bony piece at the outer margin. The *furcula* does not reach the sternum, but is connected to it by ligament only. The bones of the arm are short, the upper arm-bone does not reach farther than the crest of the ilium. The spinous processes of the dorsal vertebræ coalesce to form a single lamina. The pelvis is broad and spacious. The crop is large, and the muscular stomach very powerful.

To this order belong most of the species of birds domesticated by man, and of which none, according to the Mosaic law, were declared to be unclean. These birds live, for the most part, in polygamy; they make a rude nest on the ground of straw and fibres of plants, and lay many eggs. They feed principally on the seeds of plants, which are softened in their crop before they are triturated in the stomach or gizzard. The length of the middle toe, and some other peculiarities, give to the gallinaceous birds a remote resemblance to the vultures.

Family XII. *Megapodii.* Bill short, curved at the tip; lower mandible ascending at the tip. Wings moderate, rounded. Feet strong, large, not spurred. Toes elongate, with hallux insistent. Claws long, subcurved. Head and neck covered with thinly scattered feathers. Tail with twelve feathers.

Megapodius TEMM., QUOY and GAIM. Bill depressed at the base, with tip curved; vaulted; margin of upper mandible contracted in the middle. Nostrils pervious, oval, placed in a broad groove. Occiput subcrested. Tarsi covered anteriorly with a single row of large scutes. Middle and inner toes conjoined at the base by a small membrane. Wings with third and fourth quills longest of all. Tail short, in great part concealed by wings.

Sp. *Megapodius Freycineti* GAIM., *Voyage de l'Uranie, Zoologie,* VI. Pl. 32, TEMM. *Pl. color.* Pl. 220; entirely black; Celebes, Amboyna;—*Megapodius Duperreyi* LESSON, DUPERREY *Voy. de la Coquille, Zool.* Pl. 36, LESS. *Ornith.* Pl. 87, fig. 1, GUÉR. *Iconogr., Ois.* Pl. 57, fig. 4; New Guinea;—*Megapodius rubripes* TEMM. *Pl. color.* 411; New Guinea and Celebes; this species is very similar to the preceding; both are lead-coloured on the neck and breast, and have dun-red brown wings. These birds lay very large, dirty-white eggs, smaller at both ends, which they do not brood but cover under the sand with dead leaves.

Note.—Genus *Alecthelia* LESS. to be abolished; it is founded upon a young bird of *Megapodius.*

Leipoa GOULD. Bill depressed at the base, with tip curved, vaulted. Nostrils lateral, placed in a groove of bill, surrounded by membrane. Tarsi covered anteriorly with a double row of scutes. Hallux somewhat short. Middle and inner toes connected at the base by a small membrane. Wings with fifth quill longest of all. Tail long, rounded, flat. Orbital region naked.

Sp. *Leipoa ocellata* GOULD, *Proceed. of the Zool. Soc.* 1840, p. 126, *Birds of Australia*, v. 78; in the western part of New Holland; with black bill and legs. The feathers along the neck and on the throat small, narrow and pointed; above black, with brown-yellow spots, below light reddish-yellow.

Mesites ISID. GEOFFR. Bill rather shorter than head, nearly straight, thin, acuminate at the tip, with lower mandible ascending towards the tip. Nostrils linear, placed in a membranous pit. Tarsi covered anteriorly with a row of transverse scutes. Toes nearly cloven, the outer toes connected at the base by a rudiment of membrane. Wings with quills increasing from the first short to the fifth longest of all, with sixth and seventh subequal to this. Tail long, broad, deflected towards the sides.

Sp. *Mesites variegata* ISID., GEOFFR., GUÉR. *Magas. de Zool.* 1839, Pl. 5, 6, DESMURS *Pl. peintes* 11;—*Mesites unicolor* DESMURS, *ibid.* Pl. 12; both from Madagascar. This genus is known to me only from figures and descriptions; of the mode of life of these birds I know nothing.

Talegallus LESS., GRAY. Bill shorter than head, strong, compressed, curved, with tip of upper mandible produced beyond that of lower. Tarsi covered anteriorly with a double row of transverse scutes. Toes scarcely united at the base. Head and neck denuded. Tail elongate, rounded.

Sp. *Talegallus Cuvierii* LESS. *Voy. de la Coq., Ois.* Pl. 38, *Complém. des Œuvres de* BUFFON, 1834, *Ois.* Pl. 44, fig. 2; New Guinea;—*Talegallus Lathamii* GRAY, New Holland. These birds also lay their eggs under decaying leaves. Their presence has more resemblance than that of the other gallinaceous birds to the Vultures, but the osteological and other anatomical particulars do not confirm this apparent affinity. Compare OWEN in *Proceed. of the Zool. Soc.* 1840, p. 112.

Megacephalon TEMM. Bill moderate, compressed, with culmen acute, curved. Nostrils rounded, ample, basal. Tarsi reticulate with scales anteriorly, scutate below only at the base of toes. Anterior toes connected at the base by membrane. Tail broad, deflected towards the sides. Head and neck denuded; occiput with naked, gibbous tubercle.

Sp. *Megacephalon maleo* TEMM., GRAY *Gen. of Birds*, Pl. CXXIII.; Celebes; a bird of the size of a guinea-fowl, brown-black with violet reflections, the belly rosy-white. This species lays its eggs on heaps of leaves, without brooding them[1].

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[1] Compare TEMMINCK *Coup d'œil sur les possessions néerlandaisses*, III. 1849, pp. 116, 117.

Family XIII. *Penelopinæ*. Bill compressed, with culmen bent. Nostrils lateral. Wings rounded. Tarsi scutellate anteriorly, unarmed. Anterior toes conjoined at the base by membrane. Hallux insistent. Tail long, rounded. (Wings rounded, with 5—7 quills longest of all.)

This family is nearly allied to the preceding, but contains species from the new world only. The toes are more connected at the base than in *Megapodius*, but in this respect *Megacephalon* forms the transition to the present family.

Penelope LATH., GMEL. Bill moderate, with culmen substraight at the base, curved at the tip. Nostrils semicovered by membrane posteriorly, open forwards. Tarsus not exceeding the middle toe in length, or shorter than it. Cheeks and throat frequently destitute of feathers.

Sp. *Penelope catraca* BODD., *Phasianus motmot* GM., *Phasianus parraqua* LATH., BUFF. *Pl. enl.* 146. Genus *Ortalida* MERR., GRAY.

Penelope marail GM., BUFF. *Pl. enl.* 338;—*Penelope pipile* GM., *Crax pipile* JACQUIN, *Beiträge zur Gesch. der Vögel.* Wien, 1784, 4to, Pl. 11;—*Penelope pileata* LICHTENST., DESM., *Pl. peintes* 23, &c. Genus *Penelope* MERR., GRAY.

These birds represent in South America the Asiatic genus *Phasianus*.

Oreophasis GRAY. Base of bill thickly covered with downy plumes. Orbital region naked. Tubercle over the forehead, cylindric, truncated. Wings somewhat short.

Sp. *Penelope fronticornis* nob., *Oreophasis Derbyanus* GRAY, *Gen. of Birds*, Pl. CXXI.; from Guatemala.

Crax L. Bill moderate or short, compressed, high. Tarsi strong, longer than middle toe.

Ourax CUV., TEMM. (*Pauxi* TEMM. previously, GRAY). Bill short, densely covered with flocky plumes.

Sp. *Crax Pauxi* L., *Ourax galeata* TEMM., BUFF. *Pl. enl.* 78, CUV. *R. Ani., éd. ill., Ois.* Pl. 58, fig. 2, GRAY *Gen. of Birds*, Pl. CXXII.; Brasil, Mexico; the *Pauxi*[1] has a large, oval, bony tubercle on the head behind

[1] According to V. HUMBOLDT the name *Pauxi* in South America is not applied to a single species, but comprises the genera *Ourax* and *Crax*. *Pauxi de piedra* (*Crax pauxi*) and *Pauxi de copete* (*Crax alector*) are distinguished. *Reise in die Aequinoctial Gegenden*, IV. S. 143.

the bill; the feathers of the entire body are black, except the under part of the belly and the margin of the tail, which are whitish.

Crax mitu L., *Ourax mitu* TEMM. *Pl. color.* 153; black, the upper mandible very high, with the culmen sharp and ridged; bill and legs deep red. These birds make a nest on the ground; they protect and feed their young diligently, as do most of the gallinaceous birds.

Crax TEMM., CUV., GRAY. Bill moderate, with upper mandible vaulted, with base cerigerous.

Sp. *Crax alector* L., BRISS. *Ornith.* I. Pl. 29, BUFF. *Ois.* II. Pl. 13, LESS. *Ornith.* Pl. 81, fig. 1, *Hoco mitu-poranga* MARCGR. Brasil, p. 195; black with white belly and white margin at the tail, and transverse, sinuous, white bars on the breast;—*Crax globicera* L., BUFF. *Pl. enl.* 86;—*Crax rubra* L., BUFF. *Pl. enl.* 125, GUÉR. *Iconogr., Ois.* Pl. 39, fig. 2, CUV. *R. Ani., éd. ill., Ois.* Pl. 58, fig. 1. These birds make their nest in trees, and lay five or six eggs. They have a tuft of curled feathers, as if frizzled, on the head.

Family XIV. *Phasianinæ.* Bill moderate, vaulted, with tip of upper mandible produced beyond that of lower. Wings rounded. Tarsi covered anteriorly with scutes, in males mostly spurred. Toes four, with hallux inserted somewhat high, insistent on the point, and three anterior toes conjoined at the base by a short membrane. Cheeks or lateral parts of head unplumed. Tail broad, with mostly fourteen or eighteen feathers. Wings rounded.

Numida L. Bill shorter than head, thick, cerigerous at the base. Nostrils placed in the cere, lateral. Head and upper part of neck denuded. Wings short, with first three quills gradually longer, fourth and fifth longest of all. Tail short, deflected. Tarsi longer than middle toe, unarmed.

Sp. *Numida meleagris* L., BUFF., *Pl. enl.* 108, LESS. *Ornith.* Pl. 81, fig. 2; the *guinea-fowl, la peintade, das Perlhuhn;* with pendulous wattles at the base of upper mandibles; feathers grey-blue with round white spots; this bird, the *Meleagris* of the ancients, is, like all the species of this genus, originally from Africa; they live together in large troops.—*Numida cristata* PALL., *Spic. Zool.* IV. Tab. 2; with a tuft of black feathers on the head. —*Numida ptilorhyncha* LICHTENST., GUÉRIN *Iconogr., Ois.* Pl. 41, fig. 1, GRAY *Gen. of Birds,* Pl. CXXVIII.;—*Numida vulturina* HARDWICKE, *Proceed. Zool. Soc.* 1840, p. 52.

Agelastus TEMM. (Characters nearly of *Numida,* but tarsi spurred in males. Neck denuded. Tail longer, not deflected).

Sp. *Agelastus meleagrides* TEMM., Mus. L. B.; from the coast of Guinea; a collar of white downy feathers below the bald neck; on the rest of the body blackish feathers, with fine, interrupted, white bars.

Meleagris L. (in part)[1]. Bill shorter than head, thick, cerigerous at the base, with cere elongated into a loose, pendulous, round caruncle. Head and upper part of neck unplumed, carunculate. Wings with fifth and six quills longest of all. Tarsi much longer than middle toe, strong, armed in males with a somewhat blunt spur. Tail broad, rounded.

Sp. *Meleagris gallopavo* L., BUFF. *Pl. enl.* 97, LESSON *Ornith.* Pl. 82, fig. 2, WILSON *Americ. Ornith.* ed. JARDINE, Vol. III. Pl. 9, pp. 335—362; the *turkey, le dindon, der Truthahn;* from North America; it is no longer met with wild in the northern parts of the United States; this large gallinaceous bird was brought to Europe in the beginning of the sixteenth century, and in the tame state has degenerated from its original beauty. This species makes a rude nest of dead leaves on the ground. The male has a bunch of long, hair-like feathers on the breast. The tail can be unfolded like a fan and erected; it has 18 feathers. A somewhat smaller species from Mexico at the Bay of Honduras, has only 14 tail-feathers; it is very beautifully coloured with blue-green, round spots, with a red copper-coloured margin; *Meleagris ocellata* CUV., *Mém. du Mus.* VI. 1820, Pl. I. TEMM. *Pl. color.* 112.

Pavo L. Bill moderate, with upper mandible deflected towards the point. Nostrils lateral, longitudinal. Head plumed, with orbital region naked, crested above. Tarsi longer than middle toe, covered anteriorly with a single row of scutellae ontinued from the row of scutella of the outer toe, spurred, or in females tuberculate. Wings short, with sixth quill or fifth and sixth longest of all. Tail with 18 feathers, with coverts in males surpassing the tail-feathers in length, ocellate.

Sp. *Pavo cristatus* L., BUFF. *Pl. enl.* 433, 434, LESSON *Ornith.* Pl. 82, fig. 1; the *peacock, le paon, der Pfau;* from Thibet and other countries of the continent of India; this beautiful bird was first brought to Greece by Alexander the Great; it is now dispersed throughout the whole of Europe, to the adorning of our parks. *Pavo muticus* L., *Pavo spiciferus* VIEILL., *Pavo japonensis* ALDROV. *Ornith.* Lib. 13, cap. 3, (Tom. II. p. 17, Tab. 1, figs. 4, 5). VIEILLOT *Galerie des Oiseaux,* Pl. 202, GRAY *Gener.* Pl. 125, fig. 2. (head); this species has a copper-coloured green neck, and a bunch of long, thin feathers on the top of the head, which carry barbs from the base; it occurs at Java.

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[1] *Meleagris cristata* L. is a species of *Penelope,—Meleagris satyra* L. a species of *Tragopan* CUV., *Ceriornis* SWAINS.

Polyplectron TEMM. (species of *Pavo* L. and CUV.). Bill slender, straight, curved at the tip, covered with plumes at the base. Nostrils partly concealed by membrane, open anteriorly. Tarsi covered in front with a single row of scutella, continued from the row of outer toe, armed in males with two or three spurs, in females tuberculate. Claws small. Tail broad, rounded.

Sp. *Polyplectron bicalcaratum, Pavo bicalcaratus* L., BUFF. *Pl. enl.* 432, 493, Malacca;—*Polyplectron chinguis* TEMM., *Pavo tibetanus* BRISS. *Ornith.* I. Tab. 28, fig. 2, TEMM. *Pl. color.* Pl. 539; China, very similar to the preceding;—*Polyplectron chalcurum* TEMM., *Pl. color.* 519, Sumatra.

Crossoptilon HODGS., GRAY. Bill shorter than head, curved at the tip, with upper mandible prominent beyond the lower. Nostrils basal, lateral, with aperture ample, suboval, partly covered above by membrane. Tarsi covered anteriorly with a double row of large scutes, spurred; claws large, strong. Wings moderate, rounded, with fourth, fifth, and sixth quills subequal, longest of all. Tail broad, long, bent, with 18 broad feathers, the coverts elongate, covering the base of tail. Orbital region naked, papillose; the feathers lax, like hair.

Sp. *Crossoptilon auritum* GRAY, *Phasianus auritus* PALLAS, *Zoogr. Rosso-Asiat.* II. pp. 86, 87, GRAY *Gener.* Pl. CXXV.; Thibet, China.

Lophophorus TEMM., *Monaulus* VIEILL. Bill moderate, vaulted, with hooked tip of upper mandible produced beyond lower. Nostrils basal, lateral, partly covered by membrane. Orbital region unplumed. Feet with tarsi long, spurred, in females tuberculate, with hallux inserted somewhat high, insisting on point. Wings with fourth and fifth quills longest. Tail straight, rounded.

Sp. *Lophophorus refulgens* TEMM., *Phasianus impeyanus* LATH. Suppl. II. p. 208, Pl. 114, TEMM. *Pl. color.* Pl. 507 male, LESS. *Ornith.* Pl. 85, CUV. *R. Ani., éd. ill., Ois.* Pl. 59, fig. 3, from Nepaul; the cock is one of the most resplendent birds, with an elegant tuft; the hen is of a dull-brown colour.

Argus TEMM. Bill moderate, straight at the base, curved at the tip. Nostrils lateral, partly covered by membrane. Head and neck somewhat naked. Tarsi longer than middle toe, covered in front with a single row of large scutes, unarmed. Wings with secondaries exceeding the primaries in length. Tail elongate, compressed, with 12 feathers, the two middle longest.

Sp. *Argus giganteus* Temm., *Phasianus Argus* L., *Argus pavoninus* Vieill., Less. *Ornith.* Pl. 84, *Dict. univ. d'Hist. Nat., Ois.* Pl. 7 D; Sumatra, Borneo.

Phasianus L. (in part). Bill shorter than head, vaulted, naked at the base. Nostrils basal, partly covered by membrane. Tarsi covered anteriorly with a double row of scutes, in males spurred. Cheeks denuded. Wings short, rounded, with fourth and fifth quills longest of all. Tail elongate, cuneate, with 18 feathers.

a) *No caruncles at the sides of bill.*

Sp. *Phasianus colchicus* L., Buff. *Pl. enl.* 121, 122, Naum. Taf. 162; the *pheasant;* in the cock, head and neck blue-green; breast and belly red-brown with transverse violet bands; wings spotted brown and red; the naked ring round the eyes deep red; the hen is brown, with black and yellow spots. Like most gallinaceous birds, this bird lives in polygamy; the female lays from 8 to 15 light olive-grey or dirty-white eggs. Although now living wild in many countries of Europe, it was not originally indigenous, but an inhabitant of Asia, and was first brought by the Greeks, as is asserted, from Colchis to their own country.—*Phasianus pictus* L. Buff. *Pl. enl.* 217, Lesson *Ornith.* Pl. 83, fig. 2 (*Thaumalea* Wagl., Gray), China;—*Phasianus versicolor* Vieill., Temm. *Pl. color.* 486 male, 494 fem., Japan, &c.

b) *Naked skin below the cheeks pendent on each side as a caruncle by the sides of the bill. Gallophasis* Hodgs., Gray in part, *Euplocomus* Gray (1840).

Sp. *Phasianus nychthemerus* L., Buff. *Pl. enl.* 123 male, 124 fem.; the *silver-pheasant;* from China. All the species of this genus came originally from Asia.

Gallus Briss., Illig., Temm. Bill and other characters nearly those of the preceding genus. Head crested with elongated feathers or with fleshy, coloured skin. Naked skin below the cheeks descending at the sides of bill. Tail compressed, ascending, with 14 feathers, the coverts in males mostly elongate, curved concealing.

Sp. *Gallus gallorum* Less., *Phasianus gallus* L., Buff. *Pl. enl.* 1, 49, 98, Lesson *Ornith.* Pl. 83, fig. 1; the *common cock;* of this species there are many varieties, of which Frisch has represented some with great beauty. The wild species from which our domestic cock descends is, according to Temminck, *Gallus Bankiva,* Guer. *Iconogr., Ois.* Pl. 42, fig. 2. (It seems improbable that our poultry should be derived from any Malay breed. The introduction of the common fowl into Europe is beyond all record. See T. Crawford *Descr. Dictionary of the Indian Islands,* London, 1856, p. 113.)—*Gallus Sonnerati* Temm., Sonnerat *Voy. aux Ind. or.* II. Pl. 117, 118, Temm. *Pl. color.* 232, 233, Bengal; in the cock, neck-feathers with

horny laminæ;—*Gallus æneus* Cuv., Temm. *Pl. color.* 374;—*Gallus Lafayettii* Less., Desmurs *Pl. peintes* 18, at Ceylon, &c.

Euplocomus Temm. *Macartneija* Less., (*Gallophasis* Hodgs., Gray in part). Head ornamented with a crest of elongate plumes. Tarsi elongate.

Sp. *Gallus Cuvieri* Temm. *Pl. color.* 1, Bengal;—*Gallus ignitus, Phasianus ignitus* Shaw, Cuv. *R. Ani., éd. ill., Ois.* Pl. 61, fig. 3, &c.

Tragopan Cuv., *Ceriornis* Swainson, Gray. Head in males with two small horns behind the eyes, directed obliquely backwards. Throat with a naked, expansile caruncle on each side.

Sp. *Gallus satyrus* nob., *Meleagris Satyra* L., *Tragopan satyrus* Temm. *Pl. color.* 543 male, 544 fem., Guérin *Iconogr., Ois.* Pl. 43, fig. 4;—*Gallus Hastingsii, Tragopan Hastingsii* Vigors, Cuv. *R. Ani., éd. ill., Ois.* Pl. 62, fig. 1, (under the name of *Satyrus*).

Note.—Some sub-genera are here omitted, on which consult Gray *Genera of Birds*, III.

Family XV. *Crypturinæ* (*Tinamidæ* Gray). Bill moderate or short, slender, mostly curved abruptly at the tip, deeply cloven as far as below the posterior margin of eyes. Tarsi almost always scutellate anteriorly, longer than middle toe, unarmed. Toes cloven, the lateral toes much shorter than the middle; hallux elevated or none. Claws blunt, broad, short. Tail short or none, with coverts somewhat long, sometimes forming a false tail.

A small family of South American birds; most of them are of the size of a partridge or woodcock, and are usually coloured red-brown or grey-brown.

Crypturus Illig., *Tinamus* Lath. Bill shorter than head, with upper mandible produced beyond lower at the tip. Nostrils in the middle of bill. Wings with first quill short, fourth and fifth longest of all. Tarsi covered anteriorly with a single row of scutella. Hallux short, elevated.

Sp. *Crypturus brasiliensis, Tinamus bras.* Lath., *Tetrao major* Gmel., Buff. *Pl. enl.* 476, and *Hist. nat. des Ois.* IV. Pl. 24, Lesson *Ornith.* Pl. 89, fig. 1;—*Crypturus variegatus, Tinamus varieg.* Lath., Buff. *Pl. enl.* 828, Cuv. *R. Ani., éd. ill., Ois.* Pl. 65, fig. 3.

Sub-genus *Nothura* Wagl., Gray. Sp. *Crypturus nanus, Tinamus nanus* Temm. *Pl. col.* 316; Paraguay.

Rhynchotus SPIX, GRAY. Bill of the length of head, or a little longer than head, curved, slender, with mandibles equal. Nostrils basal. Wings with third and fourth quills longest of all. Tarsi covered anteriorly with a single row of scutes, somewhat short. Hallux short, elevated, or resting on the point of claw.

Sp. *Rhynchotus rufescens, Tinamus rufescens* TEMM. *Pl. col.* 412, GUÉR. *Iconogr., Ois.* Pl. 46, fig. 3.

Eudromia ISID. GEOFFR., *Tinomotis* VIGORS, GRAY[1]. Bill short; nostrils placed near the base. Toes short, with claws thick, sharp. Hallux none.

a) *With tarsi covered anteriorly with a single row of scutes.*

Sp. *Eudromia elegans* D'ORBIGNY and ISID. GEOFFR., GUÉR. *Magas. de Zool.* 1832, *Ois.* Pl. 1.

b) *With tarsi reticulate anteriorly, with scales large, unequal.*

Sp. *Eudromia Pentlandii* nob., *Tinamotis Pentlandii, Proceed. Zool. Soc.* 1836, p. 79.

Family XVI. *Tetraoninæ.* Bill short, broad at the base, compressed at the sides, mostly thick. Nostrils often partly covered by plumules or by a vaulted scale, basal. Head plumed, except the region above the eyes often denuded, warty. Tarsi covered anteriorly with scutes, sometimes shaggy with plumules; anterior toes mostly joined at the base by membrane; hallux elevated or resting on the point, more rarely none. Wings short, mostly rounded, with third, fourth, or fifth quill longest of all.

Hemipodius REINW., TEMM., *Ortygis* ILLIG., *Turnix* BONNAT., GRAY, *Tridactylus* LAC. Bill moderate, compressed, bent, with upper mandible produced beyond the tip of lower; lower mandible with angle somewhat prominent, ascending towards the tip. Nostrils placed in a groove of bill, marginal, partly covered by membrane. Tarsi covered before and behind by a single series of transverse scutes, with a narrow, lateral squamiferous furrow

[1] There is no satisfactory reason for preferring the name compounded by VIGORS, contrary to the rules of LINNÆUS, to that of GEOFF. ST.-HILAIRE; for *Eudromius* of BOIE, proposed as a generic name for a subdivision of *Charadrius* (*Charadrius morinellus*), has not been adopted.

between the two rows. Toes cloven, unequal; inner shorter than outer; hallux none. Wings short, with first three quills subequal, longest of all. Tail short, with 12 feathers, concealed under the coverts.

Sp. *Hemipodius tachydromus* TEMM., *Tetrao andalusicus* GMEL. and *Gibraltaricus* ejusd., GOULD *Birds of Europe*, IV. Pl. 264, *Dict. univ. d'Hist. nat., Ois.* Pl. 27, fig. 2;—*Hemipodius nigricollis, Tetrao nigricollis* GMEL., BRISS. *Ornith.* I. Tab. 24, fig. 2, BUFF. *Pl. enl.* 171, Madagascar;—*Hemipodius pugnax* TEMM. *Pl. col.* 60, fig. 2, GUÉR. *Iconogr., Ois.* Pl. 46, fig. 2; at Java and elsewhere in the East Indies; the Javanese amuse themselves with the exhibition of the combats of these little birds. There are still other different species of this genus, which belong to the smallest birds of this order; they are all from the eastern hemisphere.

Ortyxelos VIEILL., GRAY. (Bill slender. Tibiæ half-naked, as in the waders. Wings with third quill longest. Other characters those of the preceding genus, to which it has great affinity.)

Sp. *Hemipodius Meiffrenii* TEMM. *Pl. color.* 60, fig. 1, Senegal.

Pedionomus GOULD, GRAY, *Turnicigralla* DESMURS. Bill moderate, compressed towards the tip, nearly straight, with nostrils placed in an elongate groove. Tibiæ naked above the heel. Tarsi covered with scutes before and behind. Feet tetradactylous, with hallux raised, small. Wings with first three quills longest, subequal. Tail short, concealed by the feathers of the rump.

Sp. *Pedionomus torquatus* GOULD; *Proceed. of the Zool. Soc.* 1840, p. 114, *Ped. microurus*, ibid. 1842, p. 20, *Birds of Australia.*

Coturnix MOEHRING, BRISS., GRAY, *Ortygion* KEYSERL. and BLASIUS. Bill short, curved, vaulted, with tip of upper mandible produced beyond the lower. Nostrils basal, surrounded by membrane, placed near the culmen of bill. Tarsi covered anteriorly with a double row of scutes, unarmed. Anterior toes joined at the base by membrane; hallux resting on the point. Wings short, with first three quills, sometimes third and fourth subequal, longest of all. Tail very short, concealed under the feathers of rump, with 12 feathers.

Sp. *Coturnix vulgaris* JARDINE, *Coturnix dactylisonans* MEYER, *Tetrao Coturnix* L., BUFF. *Pl. enl.* 170, NAUM. Taf. 166; the *quail, la caille, die Wachtel.* A bird dispersed over many countries of Europe, Northern and Western Africa, and occurring also at the Cape of Good Hope and in

Japan; the back is rosy-yellow with black and brown, interrupted transverse bars, belly whitish; the head, which is completely feathered, has a white streak above the eyes. The quails are migratory birds in Europe. They live in polygamy, and the females lay many (8—16) eggs. The note of the male, which is heard in summer, when the moon shines, sometimes during the whole night, is well known.—*Coturnix chinensis, Coturnix excalfactoria* TEMM., *Tetrao chinensis* L., BRISSON *Ornith.* I. Pl. 25, fig. 1, GUÉRIN *Iconogr., Ois.* Pl. 46, fig. 1 (male), SONNER. *Voy. à la Nouv. Guin.* Pl. 24 (fem.); the male is bluish-grey with dark black throat, under which is a white streak; belly red-brown behind; Java and elsewhere. This species is one of the smallest of this genus, all the species of which occur only in the eastern hemisphere. In a species from Bengal the tarsi of the male are furnished with a tubercle or rudiment of blunt spur: *Coturnix cambayensis, Perdix cambayensis* LATH., TEMM. *Pl. col.* 447.

Cryptonyx TEMM., *Rollulus* BONNAT., GRAY. Bill short, thick, compressed. Nostrils lateral, longitudinal, covered by naked membrane. Orbital region naked. Tarsi long, unarmed, covered anteriorly with one row or two of large scutes. Three front toes connected at the base by membrane; hallux raised, clawless. Wings short, concave, with fourth and fifth quills longest of all. Tail short, deflected, hidden in great part by the coverts.

Sp. *Cryptonyx coronatus* TEMM. (*Columba cristata* GM. male, and *Tetrao viridis* LATH. fem.), *le Rouloul de Malacca* SONNER., *Voy. aux Ind. orient.* Pl. 113, TEMM. *Pl. color.* 350, 351, GUÉR. *Iconogr., Ois.* Pl. 43, fig. 1, LESSON *Ornith.* Pl. 86, fig. 1; common at Sumatra, occurs also at Borneo.—*Cryptonyx Dussumierii* LESS., *Perdix rufa* HARDW., *Cryptonyx ferrugineus* VIGORS; Borneo, Malacca.

Ortyx STEPHENS, *Colinus* LESSON. Bill short, thick, curved, high at the base, with tip of upper mandible produced; lower mandible short, with margin crenate or bidentate. Nostrils basal, partly covered above by a vaulted membrane. Tarsi unarmed, strong, often longer than middle toe, covered anteriorly with a double row of scutes. Hallux raised. Wings concave, with first quill short, fourth mostly longest of all. Tail with 12 feathers, mostly moderate or somewhat long.

This genus contains small species only, which are generally not larger than the quail, seldom of the size of the common partridge, and represent in North and South America the genus *Perdix*, which is wanting there. Compare D. DOUGLAS *Observations on some species of the genera Tetrao and Ortyx, natives of North America*, LINN. *Transact.* XVI. pp. 133—149.

Sp. *Ortyx virginianus, Tetrao virginianus* L. (and *Tetrao mexicanus* and *marilandicus* ejusd.), *Perdix borealis* TEMM., BUFF. *Pl. enl.* 149;—*Ortyx*

Sonninii TEMM. *Pl. color.* 75; *Ortyx californius, Tetrao californius* SHAW, GUÉRIN *Iconogr., Ois.* Pl. 45, fig. 3, LESSON *Cent. Zool.* Pl. 60, &c.

Note.—Here belong genera *Callipepla* WAGL., *Cyrtonyx* GOULD and *Odontophorus* VIEILL.

Cyrtonyx. Tail very short, concealed under the coverts. Claws elongate, curved. Sp. *Ortyx Massena* LESSON, *Illustr. de Zool.* Pl. 52.

Perdix BRISS., ILLIG. Bill short or moderate, vaulted, with tip of upper mandible often produced beyond lower. Nostrils basal, partly covered above by a vaulted naked membrane. Region near the eyes naked, papillose. Tarsi moderate or somewhat long, robust, covered in front with a double row of scutes. Anterior toes joined at the base by membrane. Tail mostly rounded, short, with 14 or 18 feathers. Wings short, with fourth quill mostly (more rarely third, or second and third) longest of all.

A. *With tarsi in males tuberculate or entirely unarmed.*

Perdix BLAS. and KEYSERL. (*Caccabis* KAUP, GRAY, add. *Starna* BONAP., BLAS. and KEYSERL., *Perdix* GRAY.) Wings with third or fourth quill longest of all. Tarsi shorter than middle toe.

Sp. *Perdix rubra* BRISS., *Tetrao rufus* L. (in part), BUFF. *Pl. enl.* 150, LESSON *Ornith.* Pl. 90, fig. 2, NAUM. Taf. 165; in the south of France, Italy, &c., where lives also the very similar *Perdix saxatilis* MEYER, *Perdix græca* BRISS. *Ornith.* I. Pl. 23, fig. 1, BUFF. *Pl. enl.* 231, which occur besides in Switzerland and Austria. In these species the males have tubercles on the tarsi, as rudiments of spurs. Such tubercles are entirely wanting in some other species, to which our *common partridge* belongs, *Perdix cinerea* BRISS., *Tetrao Perdix* L., BUFF. *Pl. enl.* 27, NAUM. Taf. 163; the legs bluish-grey, the bill brownish; under parts of the body grey with chestnut-brown spots at the sides, the wings brown, with white and black spots; this species resides on corn-lands and in the open field, makes its nest on the ground, and lays from ten to twenty light brown-grey or almost grey-white eggs, pointed at one end. This species is a permanent bird, and lives, like the other species of this genus, in monogamy.

B. *With tarsi spurred in males.*

Ithagenes. (*Ithaginis* WAGL.) Bill short, compressed, curved. Tarsi long, armed in males with two or three spurs. Wings with fourth, fifth, and sixth quills subequal, longest of all. Tail moderate, rounded.

Sp. *Perdix cruenta* TEMM., *Phasianus cruentus* HARDWICKE, TEMM. *Pl. col.* 332, CUV. *R. Ani., éd. ill., Ois.* Pl. 64, fig. 1; East Indies, Nepaul;—*Perdix Hardwickii* J. E. GRAY, *Francolinus nivosus* DELESSERT, GUÉR. *Magas. de Zool.* 1840, *Ois.* Pl. 18.

Francolinus STEPHENS, *Attagen* BLASIUS and KEYSERLING. Bill shorter than head or moderate; fissure of mouth large, produced under the eyes. Tarsi elongate, armed with a single spur in males, more rarely with two. Claws sharp, curved. Wings with fourth or third quill longest of all. Tail short.

Sp. *Perdix Francolinus* LATH. *Tetrao Francolinus* L., BUFF. *Pl. enl.* 147, 148; south of Europe, continent of India, &c.—*Perdix pondiceriana* LATH., TEMM. *Pl. col.* 213, &c.

Tetraoperdix HODGSON (*Lerwa* ejusd., GRAY). Tarsi short, thick, hirsute above, covered below with a double row of scutes in front. Wings with second and third quills subequal, the second longest of all. (Bill thick. Tail broad, rounded.)

Sp. *Perdix nivicola, Perdix Lerwa* HODGS., *Proceed. Zool. Soc.* 1833, p. 107, GRAY *Gen. of Birds*, Pl. 130, fig. 7 (fig. of head and foot); Himalayan Mountains, close to the snow-line.

Tetraogallus J. E. GRAY, *Megaloperdix* GEBL. Bill short, broad at the base, with tip curved. Head plumed, except a small triangular area behind the eyes denuded. Tarsi naked, strong, shorter than middle toe, in males armed with a thick, blunt spur. Hallux raised, short, internal. Wings with second and third quills longest of all. Tail broad, rounded.

Sp. *Perdix caucasica, Tetrao caucasica* PALL. *Zoogr. Rosso-Asiat.* II. p. 76, Tab. **;—*Tetraogallus Nigellii* J. E. GRAY, *Ind. Zool.*, and GRAY *Gen. of Birds*, Pl. CXXIX.; large grey birds, with white breast, from the Caucasus, the Altaic and Himalayan Mountains.

Tetrao L. (in part), LATH., ILLIG., *Lagopus* BRISS. Bill short, curved, thick. Nostrils basal, covered with plumules. Region over the eyes naked, papillose. Tarsi hirsute; hallux short, raised or resting on the point; claws broad. Wings with first quill short, third and fourth subequal, longest of all. Tail truncated, rounded, more rarely forked, with 16 or 18 feathers.

The *grouse* live in the northern regions of both hemispheres; they are permanent birds, and feed principally on shoots of trees and on berries. They live in polygamy. In the large species the males are very differently coloured, dark with metallic reflections. In some the lower part of the tarsi is not feathered (the sub-genus *Bonasa* STEPHENS, GRAY, *Tetrastes* BLASIUS and KEYSERLING); in others, on the contrary, even the toes are feathered as far as the claws (the genus *Lagopus* VIEILL., BLAS. and KEYSERL., GRAY).

Sp. *Tetrao urogallus* L., BUFF. *Pl. enl.* 73, 74, NAUM. Taf. 154, 155, the *cock of the wood, le grand coq de la bruyère, der Auerhahn;* in the forests of fir-trees in the temperate and northern parts of Europe and in Siberia; the largest species, larger than a turkey;—*Tetrao tetrix* L., BUFF. *Pl. enl.* 172, 173, NAUM. Taf. 157, the *black-grouse;* breeds with us (Holland) on heaths, especially in Drenthe; smaller than the preceding and with a forked tail. In Sweden a cross between these two species occurs, which has been described as a distinct species: *Tetrao medius* MEYER, NAUMANN, Taf. 156. See NILSSON (of whose observations NAUMANN gives a translation, VI. s. 314—323) *Skandinavisk Fauna*, II. 2, pp. 88—100, and *Illuminerade Figurer*, 2 Häftet, Lund, 1832, Tab. IV. *a, Tetrao hybridus urogalloides.* A very remarkable American species is *Tetrao urophasianus* BONAP., RICHARDSON *Faun. Boreali-Amer., Birds*, Tab. 58.

To the species, whose tarsi are feathered at the upper part only, belongs *Tetrao bonasia* L., BUFF. *Pl. enl.* 474, 475, NAUMANN, Tab. 158; *das gemeine Haselkuhn, la gelinotte.*

Some of the species, in which the toes also are feathered, have a white winter plumage, at which time the feathering of the toes becomes very dense, so that the claws alone appear; they are somewhat larger than a partridge. To these belongs *Tetrao lagopus* L., *Tetrao alpinus* NILSSON, BUFF. *Pl. enl.* 129 (fem. in winter plumage), 494 (in summer plumage), NAUM. Taf. 160, 161, *Ptarmigan;*—*Tetrao rupestris* SABINE, RICHARDSON *Faun. Boreal. Americ.* Pt. 2, p. 354, Pl. 64, *Rock ptarmigan*, confounded with the preceding by TEMMINCK and others; see JENYNS *Manual of Brit. Vert. Anim.* p. 171;—*Tetrao scoticus* TEMM. is larger than the preceding, the winter plumage does not differ remarkably from the summer, the general colour is a deep chestnut-brown, with black spots on the back and undulating black lines below, naked space above the eyes of a bright scarlet colour; the *red ptarmigan*, commonly called the *red grouse* or *moor-fowl.*

Family XVII. *Pteroclinæ.* Bill short, compressed at the sides, curved. Nostrils basal, concealed by the feathers of forehead. Head plumed. Tarsi hirsute, strong; toes short; hallux raised, small or none. Wings pointed, long, with first two quills longest of all. Tail elongate, cuneate.

Pterocles TEMM. Bill short, in some thick, in some slender. Nostrils basal, linear, covered with plumules above. Quill-feathers pointed, first three subequal, the first, more rarely the second, longest of all. Tarsi hirsute anteriorly, posteriorly naked, reticulate. Hallux short, internal, raised.

Sp. *Pterocles alchata, Tetrao alchata* L., *Pterocles setarius* TEMM., BUFF. *Pl. enl.* 105, 106, GUÉR. *Iconogr., Ois.* Pl. 44, fig. 3 (named *Pterocl. arenarius*), *Dict. univ. d'Hist. nat., Ois.* Pl. 27, fig. 1; South of Europe;—*Pterocles arenarius* TEMM., *Tetrao arenarius* PALL., TEMM. *Pl. color.* 52, 53, NAUM.

Pl. 153; West of Asia, South of Europe, especially Spain, met with also occasionally in Germany. These two species are the largest of this genus, of the size of a partridge; the remaining are of the size of a turtle-dove, and are almost all found in Africa. This genus forms in many respects the transition from the grouse to the dove-tribe.

Syrrhaptes ILLIG., *Nematura* FISCH. Bill small, conical. Nostrils concealed by feathers. Tarsi hirsute on all sides; toes short, concrete, hirsute above; hallux none. Two middle tail-feathers and first two quills of wings produced into setaceous, pointed filaments.

Sp. *Syrrhaptes Pallasii* TEMM., *Tetrao paradoxa* PALL., *Voyages dans plusieurs provinces de Russie*, Pl. 39, IV. p. 21, VIII. pp. 54, 55, *Zoogr. Rosso-Asiat.* II. Tab. **, p. 73 (this plate is inscribed *Tetrao arenaria* by mistake), TEMM. *Pl. col.* 95, GRAY *Gen. of Birds*, Pl. CXXXIV.; lives in the Steppes of Tartary; compare LICHTENSTEIN in EVERSMANN'S *Reise von Orenberg nach Buchara*, Berlin, 1823, s. 134—136.

Family XVIII. *Thinocorinæ*. Bill short, conical, compressed at the sides. Nostrils lateral, placed in a pit of bill, concealed by membrane beset with plumules. Tarsi denuded, scutellate or reticulate with scales. Anterior toes joined at the base by a small membrane; hallux small, raised. Wings pointed, with first quill longest of all.

Attagis ISID. GEOFFR. and LESS. Bill slender, with lower mandible shorter, narrower. Tarsi short, strong, reticulate with scales. Tail rounded, short, ample. (Eyes somewhat remote from the base of bill.)

Sp. *Attagis Gayi* ISID. GEOFF. and LESS. *Centurie Zool.* Pl. 47;—*Attagis Latreillii* LESSON, *Illustr. de Zool.* Pl. 2;—*Attagis Falcklandica*, *Perdix Falcklandica* LATH., BUFF. *Pl. enl.* 222. Birds from South America and the Falkland Islands, somewhat smaller than partridges, which have much affinity with *Chionis*, and, like the species of the following genus, form the transition to the *Grallatores*. The tarsi covered with hexagonal scales distinguish the genus *Attagis* from the rest of the gallinaceous birds.

Thinocorus[1] ESCHSCH. (*Tinocorus* LESS.). Bill short, strong. Tibiæ denuded above the heel. Tarsi covered on the anterior surface with a single row of transverse scutes. Tail short, rounded.

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[1] From θίν, θινός the *shore*, and κόρυς a *lark*, and not from χορεύω, as we read in AGASSIZ *Nomenclator zoologicus*; a work which, as far as relates to the etymology of names, deserves little reliance.

Sp. *Thinocorus rumicivorus* ESCHSCH., *Tinochorus Eschscholtzii* LESSON, ESCHSCHOLTZ *Zoologischer Atlas*, Berlin, 1829, Tab. II. LESS. *Cent. Zool.* Pl. 50 (fem. and *Thinocorus Swainsonii* LESSON, *Ill. de Zool.* Pl. 16 male?);—*Thinocorus orbignianus* LESSON, *Cent. Zool.* Pl. 48, 49; small birds from Chili, of the size of a lark, to which also in colour and form they have some resemblance.

Family XIX. *Columbinæ*. Bill short or moderate, straight, compressed, bent towards the harder tip, vaulted. Nostrils opening by a longitudinal fissure in a soft, tumid membrane covering the base of upper mandible. Feet moderate, with tarsi strong, unarmed, mostly scutellate anteriorly, very often short. Toes padded below, often surrounded by membrane, the anterior cloven; hallux long, insistent. Wings moderate. Tail with 12 feathers, mostly even or rounded, in some graduated or cuneate.

Compare on this family *Hist. nat. des Pigeons avec figures peintes, par* Madame KNIP; *le texte par* C. J. TEMMINCK, Paris, 1808—1811, folio; Tome II. *le texte par* FLORENT-PRÉVOT, Paris, 1838—1843;—on this family and the entire order C. J. TEMMINCK *Hist. nat. des Pigeons et des Gallinacées*, Amsterdam and Paris, 1813—1815, 3 Vols. 8vo.

The *doves*, not only by their toes entirely free and other peculiarities of structure, but also by their habits of life, their dwelling and making their nests in trees, &c., form the transition to the singing birds, with which LINNÆUS arranged them[1]. They form a very natural family, of which fully 200 species from all parts of the world are now known, which is much more than one-third of all the species of this order. With the exception of the aberrant genus *Didus*, and of the then unknown genus *Didunculus*, which forms the transition to it, they composed only a single genus, *Columba*, in the arrangement of LINNÆUS. He counted forty species, of which, however, some differed only in name, or were nothing but races of one species. Many species live together in large flocks. The very small *cæca* are a remarkable anatomical peculiarity of the dove-tribe, since these parts are long in the rest of the gallinaceous birds.

Columba L. Bill moderate or short, mostly slender. Wings moderate, mostly with second or third quill longest of all. Claws moderate or short, curved moderately.

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1 "Columbas *ad* Passeres *nec ad* Gallinas *pertinere docet monogamia, osculatio, incubatus alternus, nutritio pulli, ova pauca, nidificatio, locus in altis.*" *Syst. nat. ed.* 12, I. p. 284.

Modern writers, especially SWAINSON and GOULD, have divided this large genus into many genera, which, however, in part pass into one another, or sometimes are founded on insufficient characters; most of them can scarcely be regarded as sub-genera. We present below a compressed view of these divisions, but without recognising on that account an equal importance in all of them, or approving the names, frequently barbarous, by which they have been denoted.

† *Tarsi reticulate, with scales hexagonal.*

Megapelia KAUP, nob., *Lophyrus* VIEILL., *Goura* FLEMING, GRAY, *Ptilophyrus* SWAINS. Tarsi strong, elongate. Wings short, subconcave, rounded, with fourth, fifth, and sixth quills longest of all. Head ornamented with a compressed crest, formed of decomposed feathers. (These birds are the tallest of this family, except *Didus*.)

Sp. *Columba coronata* L., BUFF. *Pl. enl.* 118, SONNERAT *Voyage à la Nouv. Guinée*, Pl. 104, LESS. *Ornith.* Pl. 80, fig. 2, *Dict. univ. d'Hist. nat., Ois.* Pl. 6 A; the *goura* or *crested pigeon;* nearly of the size of a turkey-hen; greyish-blue, with a white band surrounded by red-brown across the wings. Some years ago a second species was discovered of darker colour and with a light grey band on the wings, in which the feathers of the crest end in a triangular expansion, like those on the head of the common peacock: *Columba Stuersii* TEMM. MUS. L. B., *Lophyrus Victoria* FRASER, *Proceed. Zool. Soc.*, 1844, p. 136, GRAY *Gen. of Birds*, CXX. Both species are from New Guinea; they build their nests in trees, but seek their food on the ground.

Note.—Alectryopelia [*Verrulia* (quid?) FLEMING], *Colombigalline* VAILL. Head denuded at the base of bill, with throat carunculate. Uncertain genus. Comp. GRAY *Gen. of Birds*, I. Pref. p. viii.

Sp. *Columba carunculata* TEMM., VAILL. *Ois. d'Afrique*, Pl. 278, TEMM. *Pigeons*, Pl. 2.

Perdicopelia, Starnœnas (quid?) BONAP. Head not crested. Tarsi longer than middle toe. Wings with fourth quill longest. Tail short, rounded.

Sp. *Columba cyanocephala* L., BUFF. *Pl. enl.* 174; Jamaica;—*Columba frenata*, TSCHUDI *Faun. Peruan., Av.* Tab. 27.

†† *Tarsi covered on the anterior surface with a single row of scutes.*

A. *Lateral toes subequal, or inner somewhat longer.*

Calœnas GRAY, *Geophilus* SELBY. Bill curved. Tarsi strong. Toes and claws long. Tail short, even. Wings with third quill longest.

Sp. *Columba nicobarica* L., BUFF. *Pl. enl.* 491;—*Columba cruenta* GM., SONNER. *Voyage à la Nouv. Guin.* Pl. 20, 21, CUV. *R. Ani., éd. ill., Ois.* Pl. 66, fig. 1.

"*Geophaps* GOULD. Bill vaulted, with culmen obtuse, inflated at the tip, somewhat obtuse. Tarsi strong, covered anteriorly with large transverse scutes. Tail rounded. Wings with second and third quills longest.

Sp. *Columba scripta* TEMM. *Pl. color.* 187;—*Columba plumifera* GOULD; species from Australia; the last species is small, and differs from the common form of the doves by its large head, thick bill, and whole habitus.

Phaps GOULD. Bill slender, substraight. Tarsi shorter than middle toe, naked. Tail long, rounded. Wings with second, third and fourth quills subequal, third longest of all.

Sp. *Columba leucotis* TEMM., *Pl. col.* 189; Luçon, &c.

Note.—Add sub-genus *Chalcophaps* GOULD, scarcely distinct.

Chamæpelia SWAINS. Bill slender. Tarsi shorter than middle toe, marginate externally with a line of short plumes. Wings with second, third and fourth quills longest of all, subequal. Tail moderate, rounded.

Sp. *Columba passerina* L., BUFF. *Pl. enl.* 243, fig. 1;—*Columba minuta* L., BUFF. ibid. fig. 2; very small species from America, resembling turtle-doves, of the size of a goldfinch.

Geopelia SWAINS. Bill slender. Tarsi equal in length to middle toe. Wings with third and fourth quills longest. Tail elongate, graduated.

Sp. *Columba humeralis* TEMM., *Pl. color.* 191;—*Columba lophotes* (*Ocyphaps* GOULD, GRAY) *Pl. col.* 142, Australia.

Turtur SELBY (*Peristera* BOIE). Bill slender. Tarsi almost equalling middle toe in length, naked up to heel. Inner toe longer. Wings with second and third, or third and fourth quills longest of all. Tail moderate, rounded or even.

Sp. *Columba Turtur* L., BUFF. *Pl. enl.* 394; NAUMANN Taf. 152; the *turtle-dove*, migratory;—*Columba risoria* L., BUFF. *Pl. enl.* 244; originally from Africa, but now dispersed everywhere as a house-bird;—*Col. cinerea* TEMM. *Pl. col.* 260 (*Peristera* GRAY), Brasil, &c.

Note.—Add sub-genera *Peristera* (SWAINS. previously) GRAY, *Zenaida* BONAP., GRAY.

Columba GRAY. Bill slender. Wings pointed, with second and third quills subequal, second longest of all. Tarsi short. Lateral toes equal. Tail even or subrounded, somewhat short.

Sp. *Columba Palumbus* L., BUFF. *Pl. enl.* 316, NAUM. Taf. 150; the *ring-dove;* grey, the breast purple-coloured, with a transverse spot on each side of the neck; the tail black at the extremity; on the wings a white spot, feet red. The largest native species; it lives in woods, makes its nest in trees, and is very shy.

Columba livia GESNER, BRISS., BUFF. *Pl. enl.* 510, NAUM. Taf. 150; bluish-grey, the neck glossed with green; two black transverse bars on the wings, the tail black at the extremity, the legs red. This species is found wild in many countries of Europe, especially in the south of Europe. From it descends our domestic pigeon, of which there are so many varieties, and which was employed by the ancients, as it is frequently at the present day, for the transport of written messages. (See PLINIUS *Hist. nat.* L. X. c. 37.)

Ectopistes SWAINS., GRAY. Bill slender, curved, with tip of upper mandible produced. Wings pointed, with first and second quills subequal, second longest of all. Heel plumed, tail elongate, cuneiform.

Sp. *Columba migratoria* L., BUFF. *Pl. enl.* 176, WILSON *Amer. Ornith.*, ed. JARDINE, II. Tab. 44, fig. 1; this species flies with great rapidity, and is sometimes seen in the beech-woods of North America in flocks which are counted by millions. See WILSON l. l. pp. 194—208.

Œna SELBY. (Sub-genus scarcely distinct from the preceding. Bill, however, more slender, with mandibles subequal. Wings with second quill longest of all. Tarsi with heel naked.)

Sp. *Columba capensis* L., BUFF. *Pl. enl.* 140.

Macropygia SWAINS. Bill short, slender. Wings with third quill longest. Tarsi plumed below the heel. Lateral toes equal. Tail elongate, cuneate, with feathers broad.

Sp. *Columba amboinensis* L., *Columba phasianella* TEMM. *Pl. col.* 100;—*Columba Reinwardtii* TEMM. *Pl. col.* 248. These species represent the American sub-genus *Ectopistes* at the Moluccan and Philippine islands.

Lopholaimus GRAY, *Lophorhynchus* SWAINS. Bill strong, short, compressed, curved. Wings long, with third quill longest. Tail long, subrounded.

Sp. *Columba antarctica* SHAW, *Columba dilopha* TEMM. *Pl. col.* 162; in the south of New Holland.

B. *Outer toe a little longer than inner.*

Carpophaga SELBY, GRAY. Bill moderate or short, curved, broad at the base, depressed, compressed at the tip. Tarsi strong,

short, plumed below the heel. Middle toe much longer than lateral toes; lateral toes subequal. Wings with third and fourth quills longest of all. Tail even, broad.

Sp. *Columba ænea* L., BUFF. *Pl. enl.* 164;—*Columba janthina* TEMM. *Pl. col.* 503;—*Col. magnifica* TEMM. *Pl. col.* 163;—*Columba myristicivora* SCOP., *Columba littoralis* TEMM., SONNER. *Voy. à la Nouv. Guin.* Pl. 103. A numerous sub-genus of mostly large species, all from the islands of the Indian and South Pacific Seas, or from New Holland.

Ptilonopus SWAINS., GRAY. Bill short, slender, with tip incrassate. Tarsi short, plumed. Outer toe longer. Wings with third quill longest. Tail moderate, even or subrounded.

Sp. *Columba porphyrea* REINW., TEMM., *Col. roseicollis* WAGL., TEMM. *Pl. col.* 106, CUV. *R. Ani., éd. ill., Ois.* Pl. 66, fig. 3;—*Columba viridis* L., BUFF. *Pl. enl.* 142, EYDOUX *et* GERVAIS, GUÉR. *Magas. de Zool.* 1836, *Ois.* Pl. 76, &c.

The species of this sub-genus are from the Moluccan Archipelago, the islands of the South Pacific and from New Holland; they are smaller than those of the preceding sub-genus and mostly very beautifully coloured, green with yellow and often with purple or violet head. They resemble in these colours the parrots rather than the rest of the pigeons, as do also many species of the following sub-genus.

Vinago CUV., *Treron* VIEILL., GRAY. Bill hard, strong, moderate, curved, often with tip of upper mandible produced. Wings with second and third quills subequal, third in most the longer. Tarsi short, covered with plumes below the heel. Tail even or rounded, in a few cuneate.

Sp. *Columba vernans* GM., BUFF. *Pl. enl.* 138;—*Columba abyssinica* LATH., LESS. *Ornith.* Pl. 80, fig. 1;—*Columba Capellei* TEMM. *Pl. col.* 143, (the largest of the known species). These birds also are mostly coloured green, but of a duller cast, like *Fringilla chloris;* they are found in tropical countries of the eastern hemisphere. Of the species with elongated tail-feathers SWAINSON forms the sub-genus *Sphenurus.*

Didunculus PEALE, GRAY, *Gnathodon* JARDINE. Bill moderate, thick, depressed at the base, curved, with tip hooked, sharp; lower mandible with tip truncate, tridentate on each side before the tip, with angle somewhat prominent. Nostrils linear, oblique, surrounded by membrane at the sides of mandible. Region round the orbits denuded. Tarsi equalling middle toe; toes elongate, the lateral equal. Wings tuberculate, concave, with quills pointed, the second, third, and fourth longest of all. Tail somewhat short, rounded.

Sp. *Didunculus strigirostris* GOULD, *Gnathodon strigirostris* JARDINE, *Annals of Nat. Hist.* XVI. 1845, pp. 174—176, Pl. IX., GOULD *Birds of Australia*, Part 22, GRAY *Gen. of Birds*, Pl. CXX*.

Didus L. Bill elongate, thick, curved, with tip hooked, acute. Nostrils placed at the anterior margin in the membranous part of bill. Tarsi thick, equalling the middle toe in length, reticulate with irregular scales; lateral toes equal. Claws short, thick, blunt. Wings without quills. Tail short, imperfect.

Sp. *Didus ineptus* L., EDWARDS *Gleanings*, Pl. 294, LATHAM *Synops.* III. Pl. 70, BLUMENB. *Abb. Naturh. Gegenst.* No. 35; the *dodo;* an unwieldy bird from the Island Mauritius (Ile de France), which was announced and figured by our voyagers of the sixteenth and beginning of the seventeenth centuries, but appears to have been extinct now for more than a century and a half. In England (Ashm. Mus. Oxford) the head and legs of this species is preserved; a second head (formerly in the Gottorf Museum) is preserved at Copenhagen. REINHARDT first asserted the affinity with the pigeons, which was solidly supported by STRICKLAND and MELVILLE in their extensive and accurate work on this genus. It must suffice that we point out this work, where earlier contributions to the knowledge of the Dodo are fully referred to. *The Dodo and its kindred*, by H. E. STRICKLAND and A. G. MELVILLE. London, 1848, 4to, with many figures.

Probably the *Solitaire* of LEGUAT, a bird of the Island Rodriguez, belongs also to this family, *Pezophaps solitaria* STRICKL., *Didus solitarius* GMEL. This bird is only imperfectly known. More imperfectly known still is a bird with short wings from the Island of Bourbon. Compare STRICKLAND l. l. pp. 57—60.

ORDER IV. *Scansores.* (*Zygodactyli* VIEILL.)

Bill of various shape; nostrils open. Feet for climbing; four toes, two anterior, two posterior; in a few feet tridactylous, with one toe posterior, hallux deficient.

Climbing-birds.—This order is readily distinguished by the character of the feet with only two toes directed forward, whilst the outer toe (and in some the inner toe) is directed backward. The sternum has mostly two incisures behind on each side; the *furcula* is weak. In other respects there is no such close affinity between the different families of this order as between those of the three preceding orders. Climbers in the full sense of the word are in this order the *woodpeckers* (the genus *Picus* L.) especially, but birds that climb as well as they are to be found in the following order.

† *Bill cerigerous at the base.*

Family XX. *Psittacinæ.* Bill thick, strong, high, moderate or shorter than head, with upper mandible hooked, the lower shorter, obtuse. Nostrils placed at the base of mandible near the culmen, rounded, mostly small. Tarsi reticulate with small scales, mostly short, thick. Two anterior toes conjoined by membrane at the base. Wings moderate or somewhat long, mostly with second quill longest of all.

Compare F. LEVAILLANT *Histoire naturelle des Perroquets,* II Tomes. Paris, 1801, 1805, folio; with many coloured plates. Afterwards a third part appeared as supplement, by BOURJOT SAINT-HILAIRE, Paris, 1838. H. KUHL *Conspectus psittacorum,* cum Tab. 3 æneis pictis, *Nov. Act. Acad. Leop. Car.* Tom. X. 1821, pp. 1—104;—WAGLER *Monographia Psittacorum, Abhandl. der Königl. Bayerischen Akademie der Wissensch.* I. 1832. *Mathem. physik. Klasse,* S. 463—750, cum Tab. 22—27; EDW. LEAR *Illustrations of the family of the Psittacidæ,* London, 1832, fol.; PRIDEAUX J. SELBY *The Natural History of Parrots, illustrated by 32 Plates.* Edinburgh, 1836 (*Naturalist's Library,* Vol. XV.) &c.

The Parrots.—These birds, of which nearly three hundred species are now known (LINNÆUS in 1766 numbered only forty-seven), are dispersed principally in the Southern hemisphere, in America, in the islands of the Indian Ocean, and in New Holland. They mostly make their nest in hollow trunks of trees. In the Northern hemisphere *Psittacus carolinensis* is observed up to the 42° N. L. Africa possesses only very few species. The parrots form a very natural group. The cranium is large with a transverse incisure behind the base of the bill where the movement of the upper jaw occurs. The short neck has usually twelve vertebræ. The sternum is long and narrow, and has mostly on the inferior margin, at each side, an oval aperture. The *furcula* is thin (comp. above p. 330). The tongue is commonly thick and fleshy. Many species learn to imitate the human voice. They climb, holding fast by the bill; with one of their feet they seize the food in order to carry it to the bill. Many species have very lively colours, but the colours are often gaudy and hard, and hence afford less satisfaction to the eye than the more harmonious colours of birds which are not so splendid; metallic reflections, like those in the gallinaceous birds, are not seen here. Although many arrangements of the parrots have been proposed, yet all the species compose such an independent and natural group, that only few of these divisions can be regarded as sub-genera, and scarcely any as genera. There is no

reason why a genus that contains only two or three species should be more natural than if it contained a hundred times that number; and if, with LINNÆUS, we say *character non facit genus*, we ought also to add, in his spirit, *numerus non tollit genus*. Therefore we leave most of the species under the genus *Psittacus*.

Psittacus L. Bill high at the base. Tongue thick, fleshy, obtuse. Wings with second and third or first three quills subequal, second mostly the longest of all.

† *Tarsus longer than middle toe (i. e. anterior and exterior) without the claw.*

Pezophorus ILLIG. Bill short, not as high as the forehead; upper mandible hooked at the tip; lower shorter, with angle ascending, broad. Claws slender, elongate, somewhat straight. Tail long, cuneiform, with feathers acuminate towards the extremity.

Sp. *Psittacus terrestris* SHAW, *Psittacus formosus* LATH., LABILLARDIÈRE *Voyage à la Recherche de* LA PÉROUSE, Pl. 10, LESS. *Ornith.* Pl. 19, fig. 2, GUÉRIN *Iconogr., Ois.* Pl. 37, fig. 2, SELBY *Nat. Hist. of Parr.* Pl. 29, New Holland and Van Diemen's Land; this species lives on the ground and seeks its food there amongst the bushes.

†† *Tarsus shorter than middle toe.*

Nasiterna WAGL., *Micropsitta* LESS. Bill short, high. Wings pointed, long, with first quill longest. Tail-feathers with points acuminate, naked. Toes slender, somewhat long.

Sp. *Psittacus pygmæus* QUOY and GAIMARD, *Voyage de l'Astrolobe*, Pl. 27, figs. 1—4; New Guinea; the smallest species of this whole family; not larger than the smallest native songster, ex. gr. *Sylvia regulus*.

Psittacula BRISS., GRAY (and *Agapornis* SELBY). Bill subcompressed, high, with upper mandible produced, sinuate behind the acute tip. Wings with first two quills subequal, longest of all. Tail very short.

Sp. *Psittacus passerinus* L., BUFF. *Pl. enl.* 455, fig. 1; green, the male cobalt-blue on the back behind and on the wings; the female single coloured, except the head, which is yellowish. This species occurs, like some others, in South America. Other species are from tropical countries of the Eastern hemisphere, as *Psittacus pullarius* L., BUFF. *Pl. enl.* 60. They are all small, mostly green-coloured parrots.

Psittacus nob. Bill moderate, curved. Wings produced beyond the middle or nearly to the extremity of tail, with second and third quills subequal, longest of all. Outer posterior toe subequal to anterior. Tail short, even or rounded.

Sp. *Psittacus erithacus* L., BUFF. *Pl. enl.* 311, VAILL. *Perr.* Pl. 99—103, SELBY *Parr.* Pl. 10; grey, the tail red; this species is one of the few African Parrots, and is found on the coast of Guinea; it is particularly disposed to learn to talk.

" *Note.*—Sub-genera *Chrysotis* WAGL., *Poicephalus* SWAINSON, *Chrysotis* SWAINS., *Pionus* WAGL. and *Eclectus* WAGL.; the last subdivision is in some sense intermediate between *Psittacus* and the following genus *Lorius*.

Lorius BRISS., GRAY, *Domicella* WAGL. Bill with lower mandible longer than high. Wings with second and third quills or the first three quills subequal, longest of all. Tail moderate, with feathers broad, rounded at the extremity.

Sp. *Psittacus lory* L., *Lorius tricolor* STEPH., GRAY, BUFF. *Pl. enl.* 168, CUV. *R. Ani., éd. ill., Ois.* Pl. 56, fig. 1;—*Psittacus domicella* L., BUFF. *Pl. enl.* 119, &c.; from the Moluccan Islands. The general colour of the *Lories* is a deep crimson-red; in the two species just cited the wings are green.

Tanygnathus WAGL. Bill of the length of head, high; lower mandible higher than long. Wings with second and third quills subequal, longest of all. Anterior outer toe longer than posterior outer. Tail somewhat long, graduated.

Sp. *Psittacus macrorhynchus* GMEL., BUFF. *Pl. enl.* 712; a very large species from the Moluccan Islands; green, the wings spotted with black and yellow; the large bill is of a lively red colour.

Prioniturus WAGL. Bill shorter than head, with culmen rounded. Tail moderate, even, broad, with the two middle feathers elongate, the shaft naked, vaned at the extremity, discoidal.

Sp. *Psittacus setarius* TEMM. *Pl. color.* 15; Moluccan Islands.

Platycercus VIGORS. Bill shorter than head, with culmen rounded. Wings with second and third quills subequal, longest of all. Tail elongate, broad, mostly graduated.

Sp. *Psittacus eximius* SHAW, VAILL. *Perr.* Pl. 28, 29, *Dict. univ. d'Hist. nat., Ois.* Pl. 5 A, fig. 1;—*Psittacus palliceps* VIGORS, LEAR *Parr.* Pl. 19, GUÉR. *Iconogr., Ois.* Pl. 36 bis, fig. 1;—*Psitt. scapulatus* BECHST., PHILLIP *Botany Bay*, Pl. 19, p. 153, WHITE *Journal*, Pl. 11, p. 168;—*Psittacus amboinensis* L., BUFF. *Pl. enl.* 240, &c. Most of the species are from New Holland and have very lively colours, strongly contrasted; some occur in New Guinea, as also a black species, *Psittacus Novæ Guineæ* GM., *Psittacus ater* SCOPOLI, SONNERAT *Voy.* Pl. 110.

Note.—Add sub-genera of WAGLER: *Euphema, Coracopsis, Charmosyna* and *Eos*.

Palæornis VIGORS. Bill shorter than head, curved, with tip hooked, acute. Wings with second and third quills subequal,

longest of all. Tail long, graduated, with two middle feathers elongate.

Sub-genus *Trichoglossus* VIGORS (add *Brotogeris* ejusd.). With the tip of tongue covered with setaceous papillæ. Sp. *Psittacus multicolor* GM., *Trichoglossus Swainsoni* JARDINE and SELBY, BUFF. *Pl. enl.* 743, SELBY *Parr.* Pl. 20.

Sub-genus *Palæornis* VIGORS. Sp. *Psittacus Alexandri* L., BUFF. *Pl. enl.* 642, SELBY *Parr.* Pl. 2; green, head greyish-green; a red-purple spot on the shoulder-top of the wings; neck flesh-red, a black transverse band on the throat, bill red; Hindostan.

Sub-genus *Nanodes* VIGORS, *Melopsittacus* GOULD, GRAY. Sp. *Psittacus undulatus* SHAW, LEAR *Parr.* Pl. 13, SELBY l. l. Pl. 28; a small, green species, with yellow head and brownish back, and many black transverse stripes across the neck; from the interior of Australia.

Sub-genus *Nymphicus* WAGL., *Calopsitta* LESS. Sp. *Psittacus novæ Hollandiæ* GMEL., LEAR *Parr.* Pl. 27, LESSON *Illustr. de Zool.* Pl. 49, 50, SELBY l. l. Pl. 30; grey, with an orange-coloured spot under the eyes, and a thin long crest like that of the peewit.

Conurus KUHL (in part), GRAY, *Psittacara* VIGORS. Bill moderate, curved, with tip of upper mandible produced, acute. Orbits denuded. Wings with second and third quills subequal, longest of all. Tail elongated, graduated, with feathers acuminate.

Sp. *Psittacus carolinensis* L., BUFF. *Pl. enl.* 499, WILSON *Am. Ornith.*, ed. JARD. I. p. 376, Pl. 26, fig. 1; green, head yellow, near the bill orange, shoulder-tops of wings orange, bill and legs pale yellow; the only species of parrot which occurs in the United States.—*Psittacus guyanensis* GMEL. *Pl. enl.* 167, 407, &c.

Macrocercus VIEILL., *Ara* BRISS., GRAY. Bill strong, with culmen flat, compressed at the sides, curved, high. Cheeks denuded. (Tail of *Conurus*).

Sp. *Psittacus Ararauna* L., BUFF. *Pl. enl.* 36, LEAR *Parr.* Pl. 8, SELBY l. l. Pl. 6; a very large species; back, wings and tail blue, breast and belly yellow, bill black;—*Psittacus hyacinthinus* LATH., LEAR *Parr.* Pl. 9, CUV. *R. Ani., éd. ill., Ois.* Pl. 55, fig. 1;—*Psittacus Aracanga* GM., BUFF. *Pl. enl.* 12, GUÉRIN *Iconogr., Ois.* Pl. 36, fig. 1, SELBY l. l. Pl. 7;—*Psittacus Macao* L. (in part), GM., *Ara brasiliensis* BRISS. *Ornith.* IV. Pl. 19, fig. 1, VAILL. *Perr.* Pl. 1; the two last-named species, united apparently by LINNÆUS under *Psittacus Macao*, are deep red, with blue wings and the tail blue above; the bill is whitish-yellow, with lower mandible black; but the first has, besides other characters, some yellow on the wings, by which it may be most readily distinguished. Both species occur in Brasil, the first in Guyana also and in Jamaica.

WAGLER unites this and the preceding sub-genus, *Conurus*, in a single genus *Sittace*. All the species are from America.

Cacatua BRISS.[1], GRAY, *Plyctolophus* VAILL. Bill short, strong, curved, with tip acute, end of the lower mandible truncate, emarginate. Head crested. Wings long, with second, third and fourth quills subequal, longest of all. Tail short, even.

The cockatoos are large crested, white parrots from the Moluccan and Philippine Islands and from New Holland. Sp. *Psittacus cristatus* L., BRISS. *Ornith.* IV. Pl. 21, BUFF. *Pl. enl.* 263; white, the tail yellowish below, bill and legs black.—The crest is yellow and the wings are long in *Psittacus galeritus* LATH., *Psittacus cristatus*, WHITE *Journal*, Pl. 26, p. 237, LEAR *Parr.* Pl. 3, GUÉR. *Iconogr., Ois.* Pl. 36, fig. 2.—*Psittacus rosaceus* LATH., *Psittacus moluccensis* GMEL., BUFF. *Pl. enl.* 498, LEAR *Parr.* Pl. 2, is rosy-white, the crest red within. These species, especially the last-named, are larger than the rest. To the smaller species belong: *Psittacus sulphureus* GMEL., BUFF. *Pl. enl.* 14, CUV. *R. Ani., éd. ill, Ois.* Pl. 55, fig. 5, with yellow crest and a yellow spot under the eyes.—*Psittacus philippinarum* GMEL., BUFF. *Pl. enl.* 191, with a white bill, &c. On account of its beautiful crest-feathers the following deserves notice, *Psittacus Leadbeateri* VIGORS, LEAR *Parr.* Pl. 5, SELBY l. l. Pl. 13, from New Holland.

Calyptorhynchus VIGORS and HORSF., (*Banksianus* LESS. and *Callocephalon* ejusd., *Corydon* WAGL.). Bill high, with culmen declivous, arched, with tip curved; lower mandible short, sometimes broader than upper, with tip excised, covered at the base by recumbent feathers. Tongue fleshy, smooth. Tail somewhat long, broad, rounded. Wings with third, fourth and fifth quills subequal, longest of all. Tarsi very short, covered with small scales. Feathers of the crown very often produced with a kind of crest.

Sp. *Calyptorhynchus Banksii, Psittacus Banksii* LATH., PHILLIP *Voy. to Bot. Bay*, Pl. 40, p. 267, LESS. *Ornith.* Pl. 18, fig. 2, &c. Compare LAFRESNAYE in GUÉRIN *Magas. de Zool.* 1834, *Ois.* Pl. 24—26. Large, black birds of New Holland, with red on the outermost tail-feathers. They feed not only on fruits and seeds, but also on bulbous roots.

Nestor WAGL., *Centrourus* SWAINS. Bill longer than high, compressed, curved, gaping at the sides. Claws strong, curved. Wings long, with third and fourth quills longest of all. Tail moderate, almost even, with the points of the feathers naked, acute.

Sp. *Nestor Novæ Zeelandiæ* LESS., *Psittacus australis* SHAW, SELBY *Parr.* Pl. 12;—*Nestor productus* GOULD.

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[1] This name is derived from the note of the bird, as the word *Cuculus* with the ancients.

Dasyptilus WAGL., *Psittrichas* LESS. Bill curved. Lower mandible short, emarginate before the tip. Tail moderate, rounded, broad. Wings with fourth quill longest. Head covered with rare, piliform feathers.

Sp. *Psittrichas Pecquetii* LESS., *Ill. de Zool.* Pl. 1, SELBY, l. l. Pl. 17. (This bird (from New Guinea?) I have not seen).

Microglossus GEOFFR., *Probosciger* KUHL. Bill strong, compressed, high, gaping; upper mandible hooked; furnished on each side with a large tooth, produced with acuminate tip far beyond the lower; lower mandible very short. Tongue round, extensile, with apex obtuse, transverse, horny. Head crested; cheeks naked. Tail somewhat long, rounded, broad. Tarsi very short, flattened.

Sp. *Microglossus gigas, Psittacus gigas* LATH., *Psittacus aterrimus* GMEL., LESS. *Ornith.* Pl. 19, fig. 1; GUÉRIN *Icon., Ois.* Pl. 37, fig. 1;—Another species, which might also be called *Psittacus aterrimus*, is smaller and has a smaller bald spot on the head: *Psittacus alecto*, TEMM. Mus. L. B. Both species belong to New Guinea. On the tongue compare GEOFFROY SAINT-HILAIRE *Mém. du Mus.* x. 1823, pp. 186—198; the tubercle at the end, according to this writer, alone forms the tongue, the extensile cylinder the covering of the tongue-bone; I have not been able to examine the tongue.

Strigops GRAY, (*Stringopsis*)[1]. Bill short, covered at the base by setaceous, recumbent plumes. Upper mandible curved, with culmen gibbous, vaulted. (Tongue....) Wings with fifth quill longest. Tail moderate, rounded, with feathers loose. Tarsi short, strong. Claws curved, large.

Sp. *Stringopsis habroptila, Strigops habroptilus,* GRAY *Genera* Pl. cv.; of the size of the larger species of cockatoo; the semblance of an owl; dirty-green, spotted with yellow and brown; the bill yellowish white. This singular bird is found on one of the islands of the South Pacific.

†† *Bill without cere.* Tarsi covered anteriorly with transverse scutes.

Family XXI. *Rhamphastinæ.* Bill cellular internally, large, much longer than head, with culmen convex, curved at the tip, with margins serrate. Tongue horny, feathery. Tail with ten feathers.

Rhamphastos L. (exclusive of *Rhamph. Momota*). Characters of the family those also of the single genus. Wings with quills almost concealed under the large coverts, with first quill short,

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[1] From στρίγξ, a nocturnal bird (*strix*), and ὄψις, the face; as *Loligopsis*, &c.

fourth and fifth subequal, longest of all. Tarsi covered anteriorly by large scutes. Claws curved, acute. Orbital region unplumed.

The Toucans.—These birds live in the warm countries of America. They feed on fruits and insects, but also eat eggs and young birds. The bill is of enormous size, but very light, and occupied internally by a trellis-work of bony laminæ, which is very vascular. (Compare TRAIL, *Linn. Transact.* XI. pp. 288, 289.). There is a monograph by GOULD on this genus (*Monograph of the Family of the Rhamphastidæ*, London, 1834, folio), of which a German edition, with additions, has been published by J. H. C. F. and J. W. STURM. The *furcula* consists of two bony pieces terminating below, thin, and not united. The sternum has two deep incisions on each side behind. The same applies to the skeletons which I have examined in the following family (species of *Capito*).

Rhamphastos ILLIG. Bill higher and broader than forehead. Nostrils concealed behind the prominent base of bill, surrounded by membrane. Tail even or rounded.

Sp. *Rhamphastus Tucanus* L., BUFF. *Pl. enl.* 307;—*Rhamphastus toco* GM., BUFF. *Pl. enl.* 82, LESS. *Ornith.* Pl. 25, fig. 2; in this species the bill is longer than the half of the body with the tail, of a yellow colour, with a black spot at the extremity of the upper mandible;—*Rh. discolorus* GM., BUFF. *Pl. enl.* 269, &c.

Pteroglossus ILLIG., (*Aracari* BUFF.). Bill of the height of forehead. Nostrils conspicuous in the base of bill. Tail long, graduated.

Sp. *Rhamphastus Aracari* L., BUFF. *Pl. enl.* 166, LESS. *Ornith.* Pl. 25, fig. 1;—*Rhamph. piperivorus* L., *Pteroglossus culik* WAGL., BUFF. *Pl. enl.* 577, 729;—*Rhamphastus sulcatus*, *Pteroglossus sulcatus* SWAINS., TEMM. *Pl. col.* 356, &c. These species are generally smaller than the preceding, and have the bill less large.

Family XXII. *Pogonophoræ*. Bill moderate or shorter than head, thick, furnished with bristles at the base. Anterior toes connate at the first joint. (Tail with only ten feathers in many. Wings with first quill short, fourth and fifth mostly longest of all.)

Pogonorhynchus nob., *Pogonias* ILLIG.[1], TEMM., *Pogonius* LEACH. Bill moderate, thick, with culmen arched, tip compressed, acute.

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[1] This name, already given by LACEPÈDE and CUVIER to a genus of fishes (see above, p. 179), cannot be kept. In the first edition, therefore, of this Handbook (II. p. 446), in 1833, we proposed the name of *Pogonorhynchus*; this must have escaped the notice of G. R. GRAY, generally so strict as to priority, when he adopted in his work on the *genera* of birds the name *Laimodon*, proposed by him in 1841.

Upper mandible with one or two teeth on each side. Nostrils basal, covered by bristles; long bristles below the bill, turned forwards. Tail moderate or short, even.

Sp. *Pogonorhynchus dubius* nob., *Bucco dubius* GM., *Pogonias sulcirostris* LEACH, BUFF. *Pl. enl.* 602, GUÉR. *Iconogr., Ois.* Pl. 34, fig. 2 (fig. of bill); —*Pogonorhynchus niger, Bucco niger* GMEL., BUFF. *Pl. enl.* 688, fig. 1, LESSON *Ornith.* Pl. 24, fig. 1;—*Pogonorhynchus personatus* TEMM., *Pl. col.* 201, &c. Birds of Africa, which live on fruits and insects. The females lay their eggs in hollow trunks of trees.

Capito VIEILL., *Bucco* CUV., TEMM. (and *Micropogon* ejusd.), *Capito* and *Megalaima* GRAY. Bill moderate or shorter than head, broad at the base, compressed at the sides; two mandibles subequal. Nostrils basal, lateral, covered by bristles. Wings moderate, with first quill very short, fourth mostly longest of all, fourth, fifth, and six subequal. Tail rounded.

Megalaima GRAY, *Bucco* TEMM. (add *Barbatula* LESS., *Pogoniolus* LAFRESN.). Bristles widely divergent at the base of upper mandible, often elongated beyond the tip. Tarsus shorter than anterior outer toe. Tail short.

Sp. *Capito trimaculata, Bucco frontalis* TEMM. *Pl. color.* 536, fig. 1, GUÉRIN *Icon., Ois.* Pl. 34, fig. 1;—*Capito grandis, Bucco grandis* GM., *Megalaima virens* GRAY, BUFF. *Pl. enl.* 871; green, the head greyish blue, below at the base of the tail red; from the continent of India;—*Bucco philippensis* BRISS., BUFF. *Pl. enl.* 331, of which *Buteo luteus* LESS., DESM. *Pl. peintes* 21, is an albino-variety. These birds also feed chiefly on wild berries and other fruits.

Psilopogon SAL. MUELLER. Bristles few. Tail somewhat long, graduated.

Sp. *Capito pyrolophus, Psilopogon pyrolophus* S. MUELLER in *Tijdschr. voor nat. Gesch. en Physiol.* II. p. 339, Pl. IV. fig. 3 (fig. of head), TEMM. *Pl. col.* 597, Sumatra. (The skeleton is figured in JARDINE *Contrib. to Ornith.* 1850, Pl. 54.)

Add sub-genera *Megalorhynchus* EYTON and *Psilopus* TEMM.

Capito GRAY, *Micropogon* TEMM. Bill higher than broad at the base, with culmen produced upon the forehead, bent; lower mandible straight, acuminate. Small short bristles at the sides of bill, mental none. Tail long, rounded. Tarsus equalling the anterior outer toe, or a little longer than it.

Sp. *Capito cayennensis, Bucco cayennensis* GMEL., *Capito erythrocephalus* GRAY, BUFF. *Pl. enl.* 206;—*Capito elegans, Bucco elegans* GM., *Bucco maynanensis* BRISS., BUFF. *Pl. enl.* 330;—*Capito peruvianus* GRAY, *Bucco*

peruvianus CUV., *Bucco punctatus* LESS., DESMURS *Pl. peintes* 20, &c.—Besides these species from South America, there are some also from Africa, as *Capito Vaillantii* GRAY, *Picus cafer* GM., *Micropogon sulfuratus* DE LA FRESNAYE, GUÉR. *Mag. de Zool.* 1836, *Ois.* Pl. 60;—*Capito margaritiicus* GRAY, *Micropogon margaritatus* TEMM., *Pl. col.* 490, &c. These last species form the genus *Trachyphonus* RANZANI; BONAP.

Bucco L., *Tamatia* CUV., *Capito* TEMM. (not VIEILL.). Bill moderate or long, strong, compressed towards the tip; upper mandible hooked, produced beyond the lower. Inferior margin of lower mandible long, convex, ascending. Gape ample. Nostrils placed in the base of bill, covered with recumbent plumes and setæ. Tarsi short. Tail rounded or even, moderate, or somewhat long. Wings with fourth quill longest.

Sp. *Bucco Tamatia* GM., BUFF. *Pl. enl.* 746, fig. 1, CUV. *R. Ani., éd. ill., Ois.* Pl. 52, fig. 3;—*Bucco collaris* LATH., *Bucco capensis* L., BUFF. *Pl. enl.* 395 GUÉR. *Iconogr., Ois.* Pl. 34, fig. 4 (LINNÆUS' name cannot be preserved, since this species, like all the others of this genus, belongs to South America);—*Bucco macrorhynchus* GM., BUFF. *Pl. enl.* 689, LESSON *Ornith.* Pl. 24, fig. 2 (under the incorrect name of *Tamatia melanoleuca*), &c. These species ought, with systematic zoologists, to retain the name *Bucco*, since *B. capensis* is the only species which, in the system of LINNÆUS, is brought forward under this generic name. They have not always ten tail-feathers; some have twelve, as *B. macrorhynchus*. The brown species in particular have some resemblance to *Dacelo* LEACH, a genus of the *Halcyons* living in the woods of the eastern hemisphere.

Chelidoptera GOULD, *Brachypetes* SWAINS. Bill short, curved, compressed, with tip acute. Tail short. Wings long, with second quill longest.

Sp. *Chelidoptera tenebrosa* GRAY, *Monasa tenebrio* TEMM., *Pl. col.* 323, fig. 1; Guiana. *Cuculus tenebrosus* GM., BUFF. *Pl. enl.* 505, is referred to this species, which in that case is drawn with too long a tail, and incorrectly with yellow legs (in place of black).

Monasa VIEILL., LESS., GRAY, *Lypornix* WAGL. Bill somewhat long, with tip of both mandibles bent. Wings with fourth and fifth quills longest of all. Tail elongate, broad, with 12 feathers.

Sp. *Monasa tranquilla* VIEILL., *Cuculus tranquillus* GM., BUFF. *Pl. enl.* 512, LESS. *Ornith.* Pl. 22, fig. 2; black, with orange-coloured bill; Guiana.—*Monasa* (*Lypornix*) *ruficapilla* TSCHUDI *Faun. peruan.* Tab. 24, fig. 1, &c. As in the two preceding genera all the known species of this genus occur in South America only.

Family XXIII. *Trogoninæ.* Bill short, curved, broad at the base, with margins mostly serrate or denticulate. Gape of mouth ample. Feet short. Inner toe turned backwards, outer forwards; hence the two outer toes shorter than the two inner.

Trogon L. (Characters of the family those also of the single genus. Nostrils basal, lateral, covered more or less with plumules. Recumbent bristles at the base of bill. Wings moderate, with first quill short, fourth longest of all. Tarsi slender, short, very often hirsute. Tail broad, long, sometimes with very long coverts.)

The *trogons* (*couroucous*) are tropical birds of the western and eastern hemispheres, which live in woods and feed on insects. They have some affinity with the genus *Caprimulgus*. Their plumage is soft and thick and mostly glossy, with a green metallic lustre. Their *furcula* is closed in front.

J. GOULD, *A Monograph of the Trogonidæ*, with 36 coloured plates. London, 1835—1838, folio.

a) From America:

Sp. *Trogon curucui* L., BUFF. *Pl. enl.* 452, 737;—*Trogon resplendens* GOULD, *Trogon pavoninus* TEMM. (not SPIX) *Pl. col.* 372, GUÉR. *Icon., Ois.* Pl. 35, fig. 1;—*Trogon pulchellus* GOULD, *Trogon id.* Pl. 22, *Trogon antisianus* D'ORBIGNY, GUÉR. *Magas. de Zool.* 1837, *Ois.* Pl. 85, &c.

b) From the East Indies: *Trogon Reinwardtii* TEMM., *Pl. col.* 124, &c.

Sub-genera: *Trogon* SWAINS., *Priotelus* GRAY (*Temnurus* SWAINS.), *Apaloderma* SWAINS., *Harpactes* SWAINS., and *Calurus* ejusdem. Comp. SWAINSON *Birds*, LARDNER'S *Cabinet Cyclopædia*, II. pp. 337, 338, and GRAY *Gen. of Birds*, I. pp. 69—71.

Family XXIV. *Cuculinæ* nob., *Amphiboli* ILL. (add *Corythaix* and *Musophaga*). Bill with culmen deflected in a curve into the tip. Bristles at the lower mandible none. Tongue not jaculatorial. Tarsi covered in front with a row of broad scutes; posterior outer toe versatile.

In the skeletons of this family, which I have investigated, I find the *sternum* with only one incisure on each side behind. The *furcula* is perfect and attached to the sternum.

Section I. *Musophagides.* Bill hard, high at the base, with culmen mostly keeled, deflected in an arc towards the tip. Margin of upper mandible crenate. Tarsi strong, elongate. Middle toe much longer than lateral toes, external versatile, often directed

forwards. Claws compressed, curved. Tail long, broad, with ten feathers. (All the species Africans.)

Corythaix ILLIG., *Turacus* CUV., GRAY. (*Musophaga* VIEILL. in part.) Bill short, high, compressed; upper mandible produced at the tip beyond the lower. Orbital region naked. Head armed with a mobile crest. Wings with first quill short, fourth and fifth subequal, fifth longest of all.

a) *With base of bill covered with recumbent plumes.*

Sp. *Corythaix albocristatus* STRICKL., *Cuculus Persa* GMEL. in part, BUFF. *Pl. enl.* 601, LESS. *Ornith.* Pl. 79, fig. 1; Cape of Good Hope, Mosambique; —*Corythaix persa, Cuculus Persa* L., EDWARDS *Birds*, Pl. 7, Coast of Guinea;—*Corythaix leucotis* RUEPPELL, *Neue Wirbelthiere zu der Fauna von Abyssinien*, Tab. 3, &c.

b) *With base of bill naked.* (*Nostrils in middle of bill.*)

Sp. *Corythaix gigas* STEPH., *Turacus giganteus* VIEILL., LEVAILL. *Promér. et Guép.* Pl. 19, GUÉR., *Iconogr., Ois.* Pl. 38, fig. 1; Coast of Guinea;—*Corythaix Rossæ, Musophaga Rossæ* GOULD, JARDINE *Contrib. to Ornith.* 1851, Pl. 81.

Musophaga ISERT. Bill high, moderate, naked at the base, with culmen declivous, produced above the forehead into a convex disc. Orbital region naked. Nostrils towards the anterior part of bill, near the margin. Wings with fourth quill longest. Tarsi long. Claws curved, strong. Three toes turned forward, with outer imperfectly versatile.

Sp. *Musophaga violacea* ISERT[1], LATH., LESSON *Ornith.* Pl. 79, fig. 2, SWAINS. *Birds of Western Africa*, I. Pl. 19; Senegal. This genus is scarcely distinct from the preceding, at least the last species referred to in it (under the division b) make the transition between the two.

Schizorhis WAGL., GRAY, *Chizærhis* WAGL. previously, RUEPPELL. Bill short, with culmen gibbous, not carinate, thick; nostrils open, lunate, narrow, placed at the base of bill. Wings long, with fourth, fifth, and sixth quills subequal, fourth mostly longest of all. Feathers of the occiput or the nape often elongate, forming a crest.

Sp. *Schizorhis variegata* WAGL., *Phasianus africanus* LATH., LEVAILL. *Promér.* Pl. 20, SWAINS. l. l. Pl. 20;—*Schizorhis zonura* RUEPPELL, *Neue*

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[1] *Schriften der Gesellschaft naturforsch. Freunde zu Berlin*, IX. Bd. s. 16—20, Tab. I.

Wirbelthiere, Taf. 4;—*Schizorhis personata* RUEPPELL, *Transact. Zool. Soc.* III. Pl. 16;—*Schizorhis leucogaster* Id. ib. Pl. 17.—These birds are mostly dull-coloured, grey or brown, whilst the species of the two preceding genera display beautiful and lively colours.

Section II. *Coccyginæ.* Bill of various length, often slender, moderately curved, naked at the base, sometimes emarginate towards the tip, with margins elsewhere entire. Gape of mouth large, often produced under the eyes. Tail with a various number of feathers, elongate, often graduated.

A. *Tail with not more than ten feathers.*

Crotophaga L. Bill moderate, cultrate, greatly compressed, with culmen acute. Nostrils lateral, placed near the base of bill. Tarsi long, covered with an anterior and posterior row of scutes. Tail elongate, graduated, with eight feathers rounded. Wings with first three feathers gradually longer, fourth and fifth longest of all.

Sp. *Crotophaga Ani* L., BUFF. *Pl. enl.* 102, fig. 2, LESS. *Ornith.* Pl. 26, fig. 1;—*Crotophaga sulcirostra* SWAINS., *Crotophaga Cassasii* LESS. *Cent. Zool.* Pl. 11. These two species are nearly of the same size, but the last named differs by grooves on the bill. A larger species has the bill longer and less high, with the superior margin erect at the base: *Crotophaga major* GM., BUFF. *Pl. enl.* 102, fig. 1, CUV. *R. Ani., éd. ill., Ois.* Pl. 53, fig. 2. These birds are one-coloured black with blue reflections, and have a black bill and black legs; they live together in company, especially in the neighbourhood of meadows, and make large nests in trees and shrubs of sticks and twigs, in which several females brood together. They feed on grasshoppers and other insects and often settle on the back of cattle and horses to seek for parasites.

Scythrops LATH. Bill long, large, higher than broad, with tip of upper mandible curved, acute, produced beyond the lower. Nostrils placed at the base and towards the margin of bill, half-covered by naked membrane. Tarsi strong, shorter than anterior outer toe. Tail graduated, long. Wings long, with third and fourth quills subequal, the third longest of all.

Sp. *Scythrops novæ Hollandiæ* LATH., *Scythrops Australiasiæ* SHAW, WHITE *Journal of a Voy. to New South Wales,* Pl. 5, *anomalous hornbill,* TEMM. *Pl. col.* 290, LESS. *Ornith.* Pl. 23, fig. 1, GUÉR. *Iconogr., Ois.* Pl. 33, fig. 2; at New Holland and Celebes; this bird feeds on insects, and, according to the natives, predicts bad weather by its cry. In the adult bird the ground-colour is grey, on the back and wings blackish, the belly white; the bill is grooved in the length. The young bird has a short and smooth bill and is marked with yellow-brown spots on the wings.

LAFRESNAYE has given a figure of it in GUÉRIN *Magas. de Zool.* 1835, *Ois.* Pl. 37.

Phœnicophaus VIEILL., *Melias* GLOGER, LESS., *Malcoha* VAILL. Bill moderate, broad at the base, rounded, curved at the tip. Nostrils mostly placed at the base of bill, lateral. Orbital region naked. Tarsus longer than anterior outer toe. Wings short, with fourth and fifth quills, sometimes sixth also, longest of all. Tail rounded or graduated, very long.

Sp. *Phœnicophaus viridis* VIEILL., *Cuculus curvirostris* SHAW, LESS. *Ornith.* Pl. 23, fig. 2;—*Phœnicophaus callirhynchus* TEMM., *Pl. col.* 349, CUV. *R. Ani., éd. ill., Ois.* Pl. 51, fig. 1, &c. All the species are from the East Indies.

Zanclostomus SWAINS. Bill much compressed, with tip of both mandibles curved.

Sp. *Phœnicophaus flavirostris, Zanclostomus flavirostris* SWAINS., *Birds of Western Afr.* 1. Pl. 19; from Senegal; some other species are from the East Indies.

Dasylophus SWAINS. Nostrils covered by recumbent feathers of forehead. Feathers in front of the eyes erected into a crest.

Sp. *Phœnicophaus superciliosus* CUV., GUÉR. *Iconogr., Ois.* Pl. 33, fig. 1.

Rhinorthra VIGORS, *Bubutus* LESS., *Anadœnus* SWAINS. Bill substraight, with tip abruptly curved, produced. Wings with sixth and seventh quills subequal, longest of all.

Sp. *Phœnicophaus caniceps* VIG. and HORSF., *Cuculus sumatranus* CUV., *Anadœnus rufescens* SWAINS.

Carpococcyx GRAY, *Calobates* TEMM. Nostrils somewhat remote from the base of bill, lateral, nearly covered with a corneous lamella. Wings moderate, with sixth quill longest of all. Tarsi elongate, far surpassing the anterior outer toe.

Sp. *Phœnicophaus coruscans, Calobates radiatus* TEMM., *Pl. col.* 538, Borneo.

Centropus ILLIG., *Corydonix* VIEILL. Bill shorter than head, curved, high at the base, entire at the tip. Nostrils lateral, placed at the base of bill, half covered with a scale. Tarsi longer than anterior outer toe, covered anteriorly with a row of large scutes. Claw of hallux elongate, somewhat straight, acute. Wings with fourth, fifth, and sixth quills longest of all. Tail elongate, graduate.

Sp. *Centropus senegalensis, Cuculus senegalensis* L., BUFF. *Pl. enl.* 332, SWAINS. *Birds of W. Afr.* II. Pl. 20;—*Centropus philippensis* CUV., BUFF. *Pl. enl.* 824, CUV. *R. Ani., éd. ill., Ois.* Pl. 50, fig. 1;—*Centropus nigrorufus* CUV., LESS. *Ornith.* Pl. 20, fig. 2, &c. The species named and some others are from Africa; others live on the islands of the Indian Archipelago and in Australia.

Coccyzus VIEILL., TEMM., *Macropus* SPIX. Bill shorter than head, compressed, with culmen convex, curved at the tip. Nostrils lateral, placed in the base of bill, half covered by naked membrane. Tarsus equalling anterior outer toe, covered anteriorly with a single row of scutes. Claws short. Wings with fourth or fifth quill longest of all. Tail long, graduate.

Sp. *Coccyzus americanus, Cuculus americanus* L., BUFF. *Pl. enl.* 816;—*Coccyzus dominicus, Cuculus dominicus* L., BRISS. *Ornith.* IV. Pl. 9, fig. 2;—*Coccyzus cayanus, Cuculus cayanus* L., BUFF. *Pl. enl.* 211 (*Piaya* LESS., GRAY) &c.

Add sub-genera *Coua* VAILL., GRAY (Sp. *Coccyzus madagascariensis, Cuculus madagascariensis* GM., BUFF. *Pl. enl.* 815;—*Coccyzus cristatus, Cuculus cristatus* L., BUFF. *Pl. enl.* 589, LESS. *Ornith.* Pl. 21, fig. 2, &c.), *Cultrides* PERCHERON, GRAY—(Sp. *Coccyzus Geoffroyi* TEMM., *Pl. col.* 7, GUÉR. *Icon., Ois.* Pl. 31, fig. 2) and *Diplopterus* BOIE, GRAY. (Sp. *Coccyzus guira, Cuculus guira* GM., GUÉR. *Iconogr., Ois.* Pl. 31, fig. 1;—*Coccyzus nævius, Cuculus nævius* L., BUFF. *Pl. enl.* 812, &c.)

Saurothera VIEILL., LESS. (add *Geococcyx* WAGL., GRAY, *Leptostoma* SWAINS.) Bill long, substraight, abruptly curved at the tip. Nostrils lateral, covered partly by membrane. Tarsi covered anteriorly with a single row of scutes, equalling or surpassing the anterior outer toe. Wings with fourth, fifth, and sixth quills subequal, longest of all. Tail long, graduate.

Sp. *Saurothera dominicensis* LAFRESN., BUFF. *Pl. enl.* 772 (distinct from *Saurothera jamaicensis* which is *Cuculus vetula* L.; on the synonymy consult LAFRESN. *Revue Zoolog.* 1847, pp. 353—360);—*Saurothera viatica, Cuculus viaticus* LICHTENST., *Saurothera californiana* BOTTA, *Nouv. Ann. du Mus.* IV. 1835, p. 121, Pl. 9 (*Geococcyx*);—*Saurothera affinis, Geococcyx affinis* HARTL., GRAY *Gen. of Birds* Pl. CXIV. &c. All the species American.

Cuculus L. (exclusive of many species). Bill moderate, broad at the base, depressed, compressed at the side, moderately curved. Nostrils placed at the base of bill, marginate with naked membrane. Tarsus shorter than anterior outer toe, covered anteriorly with a single row of transverse scutes, plumed below the heel. Tail

elongate, rounded or graduated. Wings moderate, with third and fourth or fourth and fifth quills longest of all.

All the species of this genus belong to the eastern hemisphere, many to Africa. Many species make for themselves no nest, but lay their eggs in the nests of other birds.

Sp. *Cuculus canorus* L., BUFF. *Pl. enl.* 811, LESS. *Ornith.* Pl. 21, fig. 1, NAUM. Taf. 127—129; the *cuccoo, le coucou, der Kuckuck.* The general colour of the adult bird is ash-grey; the belly white, with brown-black transverse streaks; the base of the bill and the legs yellow. The cuccoo feeds in the middle of summer principally upon hairy caterpillars, of which the hairs often adhere to the inner surface of the stomach in such a degree that it has been regarded as actually haired. The female lays yearly four or at most six eggs, but at such long intervals that the first has been found as early as May, the last as late as July. The slow development of the eggs in the ovary may be the cause on which the absence of inclination to brooding depends in the cuccoo[1]; whence she is contented to lay her eggs in the nest of other birds which feed their young with insects; she selects for this chiefly small species of singing birds.—*Cuculus capensis* GM., *Cuculus solitarius* VIEILL., BUFF. *Pl. enl.* 390, &c.—Some small species from warm countries have green feathers with metallic reflections. They form the sub-genus *Chrysococcyx* BOIE. Sp. *Cuculus Klaasi* CUV., VAILL. *Ois. d'Afr.* Pl. 212, SWAINS. *Birds of West. Afr.* II. Pl. 21;—*Cuculus chalcites* ILLIG., TEMM. *Pl. col.* 102, fig. 2, &c.

In some the head is crested (*Oxylophus* SWAINS.).—Sp. *Cuculus glandarius* L., *Cuculus macrourus* BREHM, *Handb.* Taf. XI. fig. 3, NAUM. Taf. 130, TEMM. *Pl. col.* 314; South of Europe, North Africa, &c. This bird is said to build its own nest.

Sub-genus *Eudynamis* VIGORS and HORSF. Sp. *Cuculus orientalis* L. (and *maculatus* GM.), BUFF. *Pl. enl.* 274, fig. 1, Pl. 764, &c.

B. *Tail with twelve feathers.*

Indicator, VAILL., VIEILL., TEMM., *Prodotes* NITZSCH. Bill short, conic, moderately curved. Nostrils placed in a fossa near the base of bill, surrounded by membrane, opening near the culmen. Tarsi short. Wings with third quill longest of all, second subequal. Tail with feathers unequal.

Sp. *Indicator Sparmanni* STEPH., *Cuculus indicator* GM.;—*Indicator minor* CUV., LESS. *Ornith.* Pl. 22, fig. 1.;—*Indicator maculatus* GRAY, *Gen. of Birds*, Pl. CXIII. *Indicator variegatus* LESS.? GUÉR. *Icon.*, *Ois.* Pl. 32,

[1] Compare H. SCHLEGEL *Natuurk. Verhand. van de Maatschappij der Wetenschappen te Haarlem*, XIX Deel. I. 1. 237—268. Amongst the earlier writers on the habits of the cuccoo we name E. JENNER in *Philos. Transact.* 1788, pp. 219—237, the discoverer of the cowpox-inoculation; according to his observations, confirmed by GLOGER, the young cuccoo throws out of the nest the young ones of its foster-mother.

fig. 2;—*Indicator albirostris* TEMM., *Pl. col.* 367, &c. Small African cuccoo-species, which feed principally on honey, and from their constant cry are easy to follow, so that they guide the natives to the resorts of the wild bees.

Leptosomus VIEILL. Bill moderate, depressed at the base, compressed at the tip, deflected; nostrils oblique, placed in the middle of bill. Tarsus thick, equalling the outer toe, covered with a double row of scutes in front. Wings with third and fourth quills longest of all. Tail even, broad.

Sp. *Leptosomus viridis* VIEILL., *Cuculus afer* GM., BUFF. *Pl. enl.* 587, 588, LESS. *Ornith.* Pl. 20, fig. 1, GUÉR. *Iconogr., Ois.* Pl. 32, fig. 1; at Madagascar; this bird lives on fruits and makes its nest in old trees. It differs from the rest of the cuccoo-tribe by its *habitus* and the straight truncated tail.

Family XXV. *Sagittilingues* (*Picidæ* GRAY, exclus. of *Capitoninæ*). Bill straight, elongate and conical, with margins very entire. Tongue jaculatorial. Tarsi covered anteriorly with a single row of transverse scutes. Feet for climbing, with posterior outer toe often longer than anterior outer. Claws curved, compressed. Tail with twelve feathers, the first minute. (Cubital coverts short, not covering the secondary quill-feathers beyond the middle.)

The *arrow-tongued birds.* Their tongue can be extended far from the bill and serves to catch insects, on which they chiefly feed. The *cornua* of the hyoïd bone are so long, that when the tongue is not extended they mount over the cranium as far as the bill, and often even pass forward into a cavity (mostly on the right side) of the upper mandible. The two *cæca* at the commencement of the large intestine are wanting, or are quite rudimentary, and so closely attached to the intestinal canal that they may easily escape observation. These birds keep principally in woods.

Yunx L. Bill short, conical, somewhat round, acuminate. Nostrils basal, approximate, narrow, surrounded by membrane. Tongue round, vermiform, with extremity simple, acute. Feet short. Tail moderate, rounded, with feathers flexile. Wings short, with first quill very small, second and third subequal, third longest of all.

Sp. *Yunx torquilla* L., BUFF. *Pl. enl.* 698, LESSON *Ornith.* Pl. 28, fig. 2, GUÉBIN *Iconogr., Ois.* Pl. 30, fig. 5, NAUM. Taf. 138; the *wryneck, le tourcol, der Wendehals;* in Europe migratory; feeds on insects, especially

on ants and their pupæ (so-named ants' eggs); it turns about its head often very far backward (hence its name). The female lays 7—11 white eggs, without building a nest, in hollows of trees, often low near the ground.—*Yunx pectoralis* VIGORS, DE LAFRESNAYE, GUÉR. *Magas. de Zool.* 1835, *Ois.* Pl. 33; from the south of Africa.

Picumnus TEMM. Bill short, with culmen substraight. Nostrils basal, covered by setaceous recumbent plumes. Tail very short, with feathers flexile, rounded at the point. Wings with first quill very short, second and third gradually longer, fourth and fifth longest of all.

a) *With hallux distinct. Piculus* ISID. GEOFFR. ST.-HIL.

Sp. *Picumnus minutissimus, Yunx minutissima* GM., *Pipra minuta* L., *Picumnus cirratus* TEMM., *Pl. col.* 371, fig. 1;—*Picumnus Buffoni* LAFRESN., BUFF. *Pl. enl.* 786, fig. 1, &c. (All the species from the tropical regions of America, except one from India at the Himalayan mountains *Picumnus innominatus* BURTON, *Proceed. Zool. Soc.* 1835, p. 154, *Vivia nepalensis* HODGSON.)

b) *With feet tridactylous, hallux none. Sasia* HODGS., *Picumnus* ISID. GEOFFR.

Sp. *Picumnus abnormis* TEMM., *Pl. col.* 371, fig. 3; Java, Sumatra, Borneo.

Picus L. Bill moderate, straight, polyhedral, with tip cuneate, compressed. Nostrils basal, oval, patulous, covered with recumbent feathers. Tongue with point subulate, horny, barbed backward. Tail cuneate, with ten feathers somewhat long, acuminate, rigid, with the two least, one on each side, incumbent on the first longer. Wings moderate, with first quill short, fourth mostly or fifth longest of all.

The *woodpeckers* live in forests, make their nest in the hollows of trees, which they chisel out with their bill, and lay their pure white eggs (3—8) on shreds of wood. They feed on insects, especially such as live under the bark of trees in decayed wood, and peck deep holes in trees in order to find them. Since, however, they spare the sound stems, they are rather useful than injurious. They climb from the root of the trees often along the stem to the top, springing with the back upwards, in which motion their rigid elastic tail is serviceable. Some species, as *Picus viridis*, seek their food on the ground also, like the wryneck. The colours are usually strongly contrasted, black and white, or green and yellow with a red spot on the top of the head.

In the skeleton the cervical vertebræ, twelve in number, are remarkable for their great development. The tail has mostly seven vertebræ, of which the last is unusually large, with strong ridge-like spinous processes and a pentangular disc on the inferior surface, and seems, from the double transverse processes, to be formed from the coalition of two vertebræ. The

sternum has two excisions at the posterior margin on each side; the *furcula* is perfectly closed, but not joined to the sternum. The quadrate bone is particularly short, and the lower jaw seems to be joined immediately to the cranium. Compare for further osteological peculiarities: E. KESSLER *Beiträge zur Naturgesch. der Specchte, Bullet. de la Soc. imp. des Natur. de Moscou,* XVII. 1844, pp. 285—362.

LINNÆUS was acquainted with only some twenty species of this genus; now it counts more than 150. Modern writers, especially SWAINSON, have attempted to form different *genera* of this genus; divisions, however, which can make no pretence to that rank, and in the arrangement can only be regarded as subdivisions for reviewing the species. The European species may be distinguished as black, variegated, and green or ground woodpeckers. Amongst the variegated woodpeckers is *Picus tridactylus* L., (NAUM. Taf. 137, black and white, with yellow crown) without hallux. Of this three-toed species LACEPÈDE has formed his genus *Picoides*, to which two North American species may also be referred; but there are Indian species, which belong to another group, which also have no hallux or only a very short one, or only a claw in place of it. The variegated woodpeckers form the sub-genus *Dendrocopus* KOCH, SWAINS., *Picus* GRAY. Sp. *Picus major* L., BUFF. *Pl. enl.* 196, 595, NAUM. Taf. 134;—*Picus medius* L., BUFF. *Pl. enl.* 611, NAUM. Taf. 136, CUV. *R. Ani., éd. ill., Ois.* Pl. 48, fig. 4;—*Picus minor* L., BUFF. *Pl. enl.* 598, NAUM. l. l. figs. 3, 4; —these three species, occurring in Germany and other parts of Europe, also in Holland, where, however, the first species only is common, are black on the back and have the wings black and white.

To the woodpeckers which are quite black or nearly so, in which the males have the head red (*Dryocopus* BOIE, *Dryotomus* SWAINS.), belong large species from America, as *Picus principalis* L., BUFF. *Pl. enl.* 690, and an European species, *Picus martius* L., BUFF. *Pl. enl.* 596, NAUM. Taf. 131, which lives in pine forests, principally in the North of Europe.

Green species, with a crest on the back of the head and the upper margin of the bill somewhat curved towards the head, form the genus *Malacolophus* SW., *Gecinus* BOIE, GRAY. Sp. *Picus viridis* L., BUFF. *Pl. enl.* 879 male, 371 fem., LESS. *Ornith.* Pl. 28, fig. 1 male, NAUM. Taf. 132; the *green woodpecker*, &c. Compare on the sub-genera, not recorded here, SWAINSON *Nat. Hist. and Classif. of Birds* (*Cabinet Cyclopæd.*), II. pp. 305—311, and GRAY *Genera of Birds.*

Family XXVI. *Angulirostres.* (*Syndactyli* ILLIG., *Galbulidæ* SELYS.) Bill elongate, straight or somewhat straight, tetragonal, acuminate. Feet very short, with two anterior toes united almost to the point, with hallux short or none.

Galbula MOEHRING, BRISS. Bill straight, carinate. A few bristles at the angle of mouth. Nostrils placed near the base of bill, oval. Feet with tarsi feathered in part, covered anteriorly with

transverse scutes, sometimes tridactylous. Wings moderate, with fourth quill longest. Tail cuneate or graduate.

Sp. *Galbula viridis* LATH., *Alcedo Galbula* L., BUFF. *Pl. enl.* 238;—*Galbula ruficauda* CUV., LESS. *Ornith.* Pl. 27, fig. 1, CUV. *R. Ani., éd. ill., Ois.* Pl. 48, fig. 1;—*Galbula albirostris* VAILL., GUÉR. *Iconogr., Ois.* Pl. 30, fig. 1;—*Galbula tridactyla* VIEILL., *Jacamaralcyon brasiliensis* LESS., *Nouv. Dict. d'Hist. nat.* Pl. E 32, fig. 2 (Tome 13, p. 401); species from the forests of tropical America; they feed on insects.

Lamproptila SWAINS., (*Jacamerops* LEVAILL.). Bill broad at the base, with culmen curved, scarcely keeled. (Head subcrested. Tail broad.)

Sp. *Galbula grandis, Alcedo grandis* GM., LEVAILL. *Ois. de Parad.* &c. Pl. 54;—*Galbula Boersii* RANZANI, LEVAILL. ibid. Pl. 53; from South Amer.

Jacamaralcyonides DESMURS. (*Galbalcyrhynchus* ejusd. previously.) Bill high at the base, with culmen subcurved, compressed towards the tip, acuminate.

Sp. *Galbula leucotis, Jacamaralcyonides leucotis* DESMURS, *Pl. peintes* 19; Columbia.

ORDER V. *Passerini.* (*Ambulatores* ILLIG., *Anisodactyli* VIEILL.)

Bill of various shape, never cerigerous at the base, acute at the tip. Tibiæ feathered as far as heel. Toes mostly four, in a few only three, the inner toe being deficient; hallux in all. Tarsi scutellate anteriorly. Claws curved, acute. Tail almost always with twelve feathers.

These birds are named *passerine* or *songsters*, because amongst them the singing birds are found which have a complex muscular arrangement at the lower *larynx* (pp. 344, 345). Yet all do not possess this arrangement, and those birds in which it is wanting are accordingly united by NITZSCH under the name of *Picariæ*, by BLASIUS and KEYSERLING under that of *Scansores*, with the climbing birds. But amongst the birds of the new world the number is much greater of species which have no special vocal muscles, as we learn from the investigation of MUELLER. Hence these birds without muscles for song, which yet, without violence to the word, cannot be named *Scansores* or *Picariæ*, have been named *Clamatores* (ANDR. WAGNER), and separated as a distinct order from the rest of the *passerines*, to which BLASIUS and KEYSERLING had already previously given the name of *Oscines*. The two divisions are also distinguished, according to these writers, by the

tarsi, which in the *Oscines* have at the sides and behind a covering which is simple and not divided into transverse scutes[1]. To this there are only few exceptions, in which the posterior surface of the tarsi is covered with transverse horny plates which in number correspond with those on the anterior surface. In the *Clamatores*, on the contrary, the tarsi are covered behind with small scales in a network, or also with transverse horny plates, which in that case are more numerous than the horny plates on the anterior surface. SUNDEVALL had already given as a character, that the coverts of the wings are short, and cover less than half the length of the secondary quill-feathers[2], a character however which is present in the woodpeckers (see above p. 456). Further he adds, that the first quill-feather is shorter than the second, and often remains rudimentary or is entirely wanting, so that there are only nine primary quill-feathers[3]. Notwithstanding all these interesting characters, still great difficulties are connected with the division of the *Oscines* and *Clamatores* into two orders or even into two groups of the same order. *Cypselus* and *Hirundo*, for instance, would then have to be separated from each other, which are not merely analogous forms like *Glareola* and *Hirundo*[4]. Nevertheless we shall as far as possible have regard to these groups, and in the first place notice the so-named *Clamatores*.

Family XXVII. *Opisthocomidæ* CABANIS (in part). Wing-coverts large. Tarsi reticulate posteriorly. Claws compressed, curved. Wings with ten primaries. Tail elongate, with ten feathers. Bill short, convex, curved at the tip. Occiput crested.

Colius BRISS., GM. Bill short, thick; upper mandible convex, sub-vaulted, produced at the tip beyond the lower. Nostrils placed in a pit at the base of bill. Orbital region naked. Tarsus covered almost entirely with a single row of large scutes, with the posterior margin alone reticulate. Hallux short, internal, versatile. Tail

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[1] *Archiv für Naturgesch.* 1839, s. 332, *u. f. f.*; H. BURMEISTER *Einige Bemerkungen, u. s. w., ibid.* 1840, s. 220—226; BLASIUS *u.* KEYSERLING *Erwiederung, ibid.* s. 362—368; see also by these writers *Die Wirbelthiere Europa's*, f. 1840, 8vo. s. 80.

[2] *Ornithologiskt System, Vetensk. Akademiens Handlingar för* 1835, pp. 43—130.

[3] *Om Foglarnes Vingar, Vetensk. Akad. Handl.* 1843, pp. 303—384. Also the normal number of secondary quill-feathers is nine, p. 377. Compare CABANIS *Ornith. Notizen, Arch. f. Naturgesch.* 1847. s. 186—256, s. 303—352.

[4] It is not, I trust, to be ascribed only to custom and to prejudice in favour of a division generally adopted previously, if I cannot divest myself of this opinion.

longer than body, with feathers narrow, the outer on each side rather small, the two middle very long. Wings short, with third, fourth, and fifth quills subequal, third mostly longest of all.

Sp. *Colius senegalensis* GM., *Lanius macrourus* L. (*Syst. nat.* ed. 12, I. p. 134). BRISS. *Ornith.* III. Pl. 16, fig. 3, BUFF. *Pl. enl.* 282, fig. 2, GRAY *Gener.* Pl. XCVI.; grey-brown, a cobalt-blue spot on the neck;—*Colius capensis* GM. (and *erythropus* ejusd.), *Loxia Colius* L., *Colius leuconotus* LATH., *Colius erythropygius* VIEILL., BRISS. l. l. fig. 2, BUFF. *Pl. enl.* 282, fig. 1, LESS. *Ornith.* Pl. 57, fig. 1; GUÉR. *Iconogr., Ois.* Pl. 19, fig. 7, &c. They are all African birds, feeding on fruits (berries, &c.), they climb on trees and fly little and only to short distances. Compare RUEPPELL *Mus. Senkenb.* III. pp. 39—44.

Opisthocomus HOFFMANSEGG, ILLIG. Bill thick, short; lower mandible with angle somewhat prominent, ascending to the tip. Nostrils lateral, placed in the middle of bill, covered above by membrane. Tarsi strong, covered on every side by long hexagonal scales. Toes long, with strong claws; hallux not versatile. Tail elongated, rounded. Wings with sixth quill longest.

Sp. *Opisthocomus cristatus, Phasianus cristatus* GM., BUFF. *Pl. enl.* 337, LATH. *Synops.* II. Pl. LXIV, GUÉR. *Iconogr., Ois.* Pl. 39, fig. 1, GRAY *Gener.* Pl. XCVIII.; from the North of South America. Formerly this genus was usually referred to the gallinaceous birds, from which, however, it differs by the toes completely cloven. Compare on the affinity of this bird DEVILLE in GUÉRIN *Magas. de Zool.* 1852, pp. 217—224, Pl. 9.

Family XXVIII. *Bucerotinæ*. Wing-coverts large. Tarsi covered anteriorly with transverse scutes, reticulate posteriorly. Wings with ten primaries. Tail long, with ten feathers. Bill large, long. Anterior outer toes connected together, separate at the apex only. (*Pedes gressorii* L.)

Buceros L. Bill large, hollow, in adults obsoletely serrate or denticulate at the margins and often furnished with a hollow appendage above the culmen. Nostrils placed at the base of bill near the culmen, small. Orbital region (or whole face) and part of the throat destitute of feathers. Wings moderate, with first three quills gradually longer, fourth or fifth longest of all.

a) *Tarsi short, strong. Buceros* GRAY. (*Buceros* and *Tockus*/ LESS., *Rhynchaceros* GLOGER.)

Sp. *Buceros rhinoceros* L., LESSON *Ornith.* Pl. 31, BLUMENB. *Abb. Naturh. Gegenst.* No. 24; on the islands Sumatra and Borneo. A local variety of Java is *Buceros lunatus* TEMM. *Pl. col.* 546;—*Buceros hydrocorax* L., BUFF.

Pl. enl. 283 (young bird), GUÉRIN *Iconogr., Ois.* Pl. 29, fig. 2; Philippine Islands;—*Buceros ruficollis* VIEILL., LABILLARDIÈRE *Voyage à la Rech. de* LA PEYROUSE, Pl. 11, TEMM. *Pl. col.* 557; New Guinea, Ceram, Amboyna, &c.

b) *Tarsi elongate. Tmetoceros* CABANIS, (*Bucorvus* LESS., GRAY).

Sp. *Buceros abyssinicus* GM., BUFF. *Pl. enl.* 779; here the horny excrescence on the bill is as though excised in front and open.

All these birds live in warm countries of the eastern hemisphere. They are the largest of this order; their food consists principally of fruits. They are shy, have a loud one-noted cry, and make their nests in holes of trees. Many species are figured in TEMMINCK'S *Pl. col.* which work may be principally consulted on this genus.

Family XXIX. *Coracianæ.* Wing-coverts large. Tarsi covered anteriorly with transverse scutes, reticulate posteriorly. Outer toes united at the base only or free. Wings with ten primaries. Bill moderate or long cultrate, with tip of upper mandible curved, produced beyond the lower. Nostrils basal, lateral, longitudinal, oblique. Tail with twelve feathers, mostly moderate. Claws compressed, curved, acute.

Eurycerос LESS. Bill long, with culmen high, curved; greatly compressed towards the tip; upper mandible emarginate before the tip. Outer toes united at the base. Hallux large. Wings with fourth and fifth quills subequal, longest of all. Tail moderate, rounded.

Sp. *Eurycerос Prevostii* LESS., *Centurie Zool.* Pl. 74, *Illustr. de Zool.* Pl. 13; Madagascar. This bird, of the size of a thrush, is black, with back and wing-coverts cinnamon-brown. It seems probable to me that it ought to be placed here; to the preceding family at least, in which LESSON and GRAY have arranged it, it does not appear to belong.

Colaris CUV., *Eurytomus* VIEILL., GRAY. Bill shorter than head, curved abruptly at the tip, broad at the base, compressed towards the tip, with gape ample. Recumbent bristles at the angle of mouth. Outer toes united at the base, nearly equal. Hallux large. Tarsus shorter than middle toe. The long wings produced almost as far as the posterior margin of tail, with second quill longest of all. Tail moderate even.

Sp. *Colaris orientalis, Coracias orientalis* L., BUFF. *Pl. enl.* 619; East Indies and China;—*Colaris madagascariensis, Coracias madagascariensis* GM., BUFF. *Pl. enl.* 501, LESS. *Ornith.* Pl. 49, fig. 2.

Chloropygia SWAINS., *Brachypteracias* LAFRESN. Bill moderate, compressed, with culmen curved. Outer toes free. Hallux

short. Tarsus longer than middle toe. Wings short, with fourth and fifth quills longest of all.

Sp. *Chloropygia leptosoma* SWAINS., *Colurus leptosomus* LESS. *Cent. Zool.* „ Pl. 20, LAFRESNAYE, GUÉR. *Magas. de Zool.* 1824, *Ois.* Pl. 31;—*Chloropygia pittoides* LAFRESN. *ibid.* Pl. 32;—*Chloropygia squamigera, Brachypt. squamigera* LAFRESN., DESMURS *Pl. peint.* 39; all from Madagascar. PUCHERAN forms of the two last species, whose tarsi are longer than those of the first species, a distinct genus, *Atelornis; Revue Zool.* 1846, pp. 193—200.

Coracias L. (in part). Bill moderate, compressed towards the tip, with tip curved abruptly. Outer toes free. Tarsus shorter than anterior middle toe. Wings elongate, with second quill longest of all. Tail even, rounded, with outer feather on each side often longer than the rest, sometimes elongate, acuminate.

Sp. *Coracias garrula* L., BUFF. *Pl. enl.* 486, NAUM. Taf. 60, LESSON *Ornith.* Pl, 49, fig. 1; the *garrulous roller, le collier, die Racke;* the general colour is blue-green, the back cinnamon-brown, bill black, the legs yellow. This bird lives in woods, feeds chiefly on large insects, and lays from four to six white eggs in hollow trees. In its internal structure it corresponds in some respects with the kingfishers and the bee-eaters, (*Alcedo* and *Merops*).—*Coracias caudata* L., *Galgulus angolensis* BRISS. *Ornith.* II. „ Pl. 7, fig. 1, BUFF. *Pl. enl.* 88, DESMURS *Pl. peintes* 28;—distinct from *Coracias abyssinica* GM., BUFF. *Pl. enl.* 626; see DESMURS *op. cit.*

Family XXX. *Meropinæ.* Wing-coverts large. Primaries ten. Tarsi covered anteriorly with transverse scutes. Two outer toes united, separate only at the apex. Bill subcurved. Nostrils basal, lateral, partly covered by feathers of forehead. Tail long or somewhat long, with twelve feathers.

Prionites ILLIG., *Momotus* BRISS. (species of *Rhamphastus* L.). Bill moderate, cloven as far as under the eyes, with margins serrate. Tongue narrow, horny, feathery. Tarsus covered anteriorly and posteriorly with a row of transverse scutes, reticulate at the sides, equalling or surpassing the anterior middle toe. Tail cuneate, with two middle feathers with stem sometimes produced beyond the rest and denuded before the vaned termination. Wings with fourth and fifth quills subequal, fourth longest of all.

This genus contains South American birds which, as CUVIER has correctly observed, represent the genus *Merops* of the eastern hemisphere. They live in forests and feed chiefly on insects. They are coloured sea-green and blue, and in form also most of them have much resemblance to each other.

Sp. *Prionites brasiliensis, Rhamphastus Momota* L., BUFF. *Pl. enl.* 370, LESS. *Ornith.* Pl. 30, fig. 2, &c.;—*Prionites Lessonii, Momotus Lessonii* DESMURS *Pl. peintes*, 62, &c. Species, whose bill is broad and flat at the base, form with SWAINSON the genus *Crypticus*. (Sp. *Prionites platyrhynchus, Momotus platyrhynchus* JARDINE and SELBY *Ill. of Ornith.* Pl. 106;—*Prionites superciliosus, Crypticus superciliosus* SWAINS.) In the last species noted the notches at the margin of the bill are fine and scarcely to be observed by the naked eye. The same is the case with a small Mexican species (not much larger than a common kingfisher), *Prionites momotula, Hylomanes momotula* LICHTENST, *Abhandl. der Akad. der Wiss. zu Berlin, Physik-math. Klasse*, 1838, p. 449, Pl. IV., GRAY *Gen. of Birds*, I. Pl. XXIV.; it has a shorter tail and somewhat longer tarsi than the rest.

Merops L. Bill moderate or long, arched, acuminate, with margins very entire. Tongue narrow, with apex horny, laciniate. Tail long, subeven. Tarsi short, reticulate posteriorly. Tibiæ denuded above the heel. Wings with first quill mostly very small, second, more rarely third or fourth, longest of all.

a) *Wings long. Tail with two middle feathers elongate.*

Sp. *Merops apiaster* L., BUFF. *Pl. enl.* 938, LESSON *Ornith.* Pl. 30, fig. 1, NAUMANN Taf. 143; the *bee-eater, le guépier, der Bienenfresser;* the back red-brown, the throat yellow with a black margin, breast and belly greenish-blue; this bird lives in the south of Europe and in Africa, and feeds on insects, especially wasps and bees, which it captures on the wing, like swallows; has been seen, though very rarely, in England;—*Merops nubicus* GM., BUFF. *Pl. enl.* 649, &c.

b) *Wings short, rounded. Tail forked or emarginate.* Sub-genera *Melittophagus* BOIE and *Nyctiornis* SWAINS., *Alcemerops* ISID. GEOFFR.[1]

Sp. *Merops amictus* TEMM., *Pl. col.* 310, GUÉRIN *Iconogr., Ois.* Pl. 27, fig. 1; green, head violet-red on the top, throat bright blood-red; a large species from Borneo and Sumatra;—*Merops gularis* LATH., SHAW, *Melittophagus gularis* GRAY, *Gener. of Birds*, Pl. XXX. &c.

Family XXXI. *Halcyoninæ.* Wing-coverts large. Primaries ten. Tarsi short, covered anteriorly with transverse, distinct or obsolete scutes, sometimes reticulate. Two outer toes united, distinct only at the apex. Bill long, straight, with culmen keeled. Nostrils basal, lateral, small. Tibiæ denuded below towards the heel. Tail with twelve feathers.

The *kingfishers* form a natural family, of which about eighty species are now known. Only very few occur in the new world;

[1] *Nouv. Ann. du Mus.* I. 1832, p. 395.

most of the species inhabit the islands of the Indian Archipelago or of the South Sea. This group corresponds to the genus *Alcedo* of LINNÆUS, with the exception of his last two species, which belong to the genus *Galbula* (see above p. 458).

Alcedo L. (*Alcedo* SWAINS., GRAY, *Alcyone* SWAINS., GRAY.) Bill slender, compressed, acute at the tip. Wings with second and third quills subequal, third longest of all, first little shorter than these. Tail very short, even. Feet weak; anterior inner toe very short or none.

Sp. *Alcedo ispida* L., BUFF. *Pl. enl.* 77, NAUM. Taf. 144, CUV. *R. Ani., éd. ill., Ois.* Pl. 46, fig. 1; the *kingfisher, le martin-pêcheur, der Eis-vogel;* the middle of the back azure-blue, the wings blue-green, abdomen ferruginous, the throat white, the legs red, the bill brown-black; a shy, solitary bird of passage, commoner in the south than in the north of Europe; occurs also in Asia Minor and the North of Africa; it feeds on fish, and watches for its prey on the banks of rivers often for hours together. The nest is a narrow hole dug by its bill in the bank near the water's edge and covered with fine fish-bones. The female lays from 6 to 8 glossy white eggs. The young, at first entirely naked, are fed with *Libellulæ*.—A very similar, somewhat smaller species of Asia, is *Alcedo bengalensis* GM., which occurs not only in Bengal, but also at Timor, the Philippine Islands and Japan, *Faun. Jap. Av.* Tab. 38;—*Alcedo cristata* L., BUFF. *Pl. enl.* 756, fig. 1, LESSON *Ornith.* Pl. 29, fig. 1. GUÉR. *Iconogr., Ois.* Pl. 28, fig. 1; a small species, blue above, ruddy below, with crest-feathers blue with black spots; from the Cape of Good Hope.

The species without inner toe (*pedibus tridactylis*) form the sub-genus *Alcyone* SWAINS., GRAY. To it belong *Alcedo solitaria, Ceyx solitaria* TEMM. *Pl. col.* 595, fig. 2;—*Alcedo pusilla, Ceyx pusilla* TEMM. ib. fig. 3, a very small species; head, back, wings and tail azure-blue, breast and belly pure white; both from New Guinea, &c.

Ceryle BOIE, GRAY, *Ispida* SWAINS. Bill thick, compressed, acute at the tip. Tail somewhat long, rounded. Anterior inner toe longer than hallux. (Other characters of the preceding genus.)

Sp. *Ceryle rudis, Alcyon rudis* L., BUFF. *Pl. enl.* 716 (and 62, young bird); Western Asia and Europe;—*Ceryle maxima, Alcedo maxima* PALL., *Ispida gigantea* SWAINS. *Birds of West. Africa,* II. Pl. 11, BUFF. *Pl. enl.* 679, Senegal;—*Ceryle lugubris, Alcedo lugubris* TEMM. *Pl. col.* 548, *Faun. Jap. Av.* Tab. 38 B, from Japan, &c. They are all large birds, black and white variegated, or bluish-grey plumage. To this genus alone the few American species of this family belong, as *Ceryle Alcyon, Alcedo Alcyon* L., BUFF. *Pl. enl.* 715, WILSON *Am. Ornith.*, ed. JARD. I. Pl. 23, fig. 1, p. 348; in North America from Hudson's Bay to Mexico; the only species of kingfisher of the United States.

Halcyon SWAINS. Bill long, sometimes very long, broad at the base, somewhat depressed. Lower mandible angulate at the inferior margin, ascending towards the tip. Wings with first quill short, third longest of all. Tail short or moderate, rounded.

Sp. *Halcyon concreta, Dacelo concreta* TEMM. *Pl. col.* 346, *Dict. univ. d'Hist. Nat., Ois.* Pl. 4, fig. 2; Sumatra;—*Halcyon Smyrnensis, Alcedo Smyrnensis* L., ALBIN *Av.* III. Pl. 27, 28, BUFF. *Pl. enl.* 894; Asia Minor, Bengal, Ceylon, Philippine Islands. (Comp. on this species STRICKLAND *Ann. and Mag. of Nat. Hist.* IX. 1842, p. 441);—*Halcyon leucocephala, Alcedo capensis* L. *Pl. enl.* 590; a large species with very large pale orange-coloured bill, from the East Indies and not from the Cape, &c.

Ceyx LACEP. (not TEMM.). Bill of Halcyon, but *habitus* of *Alcedo*. Tail very short. Feet tridactylous, with inner toe none.

Sp. *Halcyon purpurea, Alcedo tridactyla* PALL. *Spic. Zool.* VI. Tab. II. fig. 1; VOSMAER *Boschrijving van twee kortstaartige Oost-Indische ijsvogeltjes met twee voor-en eenen achtervinger.* Amsterd. 1768, 4to.

Paralcyon GLOGER, *Dacelo* LEACH[1]. Bill depressed at the base, broad, inflated; lower mandible gibbous beneath, ascending towards the tip; upper longer, with tip curved. Wings with first quill short, second and third gradually longer, fourth mostly longest of all. Tarsi reticulate. Tail moderate, broad, or somewhat long, cuneate.

Sp. *Paralcyon gigantea, Alcedo gigantea* LATH., BUFF. *Pl. enl.* 663, WHITE *Voy.* Pl. 53, p. 237, New Holland, &c. These birds feed on insects, small reptiles and even on snakes.

Note.—On some other subdivisions cons. GRAY *Gen. of Birds*, Vol. I.

Family XXXII. *Upupinæ*. Wing-coverts short. Primaries ten. Tarsi with transverse scutes anteriorly. Tail with ten or twelve feathers. Bill slender, arched, long or moderate; nostrils basal, lateral. Two outer toes united at the base only.

Upupa L. (in part). Bill elongate, moderately curved. Head crested. Tarsi reticulate posteriorly. Claws short; claw of hallux longer than the rest, somewhat straight. Wings with first quill short, fourth longest of all. Tail even, broad, with ten feathers.

Sp. *Upupa Epops*, L., BUFF. *Pl. enl.* 52; LESSON *Ornith.* Pl. 79, fig. 2, NAUM. Taf. 142; *the hoopoe, la huppe, der Wiedekopf;* this bird has a crest on the head of two rows of long feathers brownish or ruddy, spotted black,

[1] A word without signification, anagram of *Alcedo*.

which it can erect. The tail is black with a white transverse bar in the middle; the wings also are black with white transverse bars; the head, neck and breast ruddy. The *hoopoe* is a bird of passage which feeds on larvæ of insects, which it mostly picks from the ground; its nest is made in hollow stems of trees, and contains from four to six dirty greenish-white eggs. The oily matter secreted by the sebaceous gland on the tail-bone, assumes in the female at brooding-time and in the young in the nest an intolerable stench (NITZSCH *Pterylographie*, s. 58, 149), whence arose the unfounded opinion that the *hoopoe* makes its nest of cow-dung. The bird is more common in the South than in the North of Europe, rare in Holland as also in England; it occurs also in North Africa; in Senegal and at the Cape of Good Hope a very similar species is found, *Upupa minor* GM., *Upupa cristatella* VIEILL., *Galerie des Ois.* Pl. 184, GUÉR. *Icon., Ois.* Pl. 26, fig. 1[1].

Falculia GEOFFR. SAINT-HIL. Bill long, compressed, arched. Lateral nostrils patulous. Wings with fourth quill longest of all, third and fifth subequal. Tail with 12 feathers, even. Claws curved, compressed; claw of hallux very large.

Sp. *Falculia palliata*, ISID. GEOFFR. SAINT-HILAIRE in GUÉRIN *Mag. de Zool.* 1836, *Ois.* Pl. 49; from Madagascar.

Irrisor LESS. (add *Rhinopomastes* SMITH.) Bill long or moderate, arched, compressed, acute. Nostrils basal, partly covered by plumules. Gape of mouth produced under the eye. Tarsi short, covered anteriorly and posteriorly with a row of transverse scutes. Claws compressed, curved. Wings with fourth, fifth, and sixth quills subequal, longest of all. Tail elongate, cuneate.

To this genus belong African birds which were formerly classed with *Promerops*, but which CUVIER placed with *Merops*. Sp. *Irrisor erythrorhynchus, Upupa erythrorhyncha* LATH.;—*Irrisor melanorhynchus, Upupa melanorhyncha* LICHTENST., GRAY *Gen. of Birds*, Pl. XXXI. &c. The bill in the male is (at least in some species) longer and more curved, in the female shorter and higher.

Family XXXIII. *Trochilidæ*. Wing-coverts covering almost entirely the secondary quill-feathers which are very short. Primaries ten. Tarsi weak, plumed, or covered anteriorly with transverse, obsolete scutes. Two outer toes united at the base only. Bill slender, tubular, with upper mandible ensheathing the lower.

The *humming-birds* or *colibris* are small birds richly ornamented which are found in the western hemisphere only, especially in South America; they feed on insects. The cornua of the hyoïd

[1] *Upupa capensis* GMEL., BUFF. *Pl. enl.* 697, does not belong to this genus nor to this family. GRAY, who judges differently of it, seems not to have examined the bird.

bone extend over the cranium, as in the woodpeckers. The skeleton is distinguished by a very short humerus; the bones of the fore arm also are short, and are exceeded in length by those of the hand. The keel of the sternum is large and high; the *furcula* is thin. The neck is very long, although the vertebræ are only thirteen in number. With the tongue, bifid at the extremity, they catch insects at the bottom of flowers.

The peculiar smallness of most of the humming-birds deserves remark; SLOANE speaks of a little bird which during life weighed only 20 grains, *Trochilus minimus*, LINN. *Syst. Nat.* I. p. 193, ed. 12; when, however, BEIREIS makes mention of a specimen which weighed only 6 grains (*Syst. Nat.* ed. 13, *cura* GMELIN, I. p. 500), it may be surmised with RUDOLPHI, that it was imperfect and dried, or half destroyed by worms, *Bemerkungen auf einer Reise*, 1804, 8vo. I. s. 65.

Compare on this family the three splendid works of LESSON, entitled, *Histoire naturelle des Oiseaux-mouches*, Paris, 1828—1830; *Hist. nat. des Colibris*, Paris, 1830, 1831; *Les Trochilidées ou les Colibris et les Oiseaux-mouches*, Paris, 1832, 1833, and GOULD'S valuable *Monograph of the Trochilidæ or Humming-Birds*. London, 1850, and foll. (up to Oct. 1852, 4 parts. fol. The plates present an imitation of the original play of colours of the plumage hitherto unknown.)

Trochilus L. (Characters of the family. Wings long, narrow, with first quill longest of all, the posterior suddenly decreasing. Tail with ten feathers.)

Τρόχιλος is the name of a bird mentioned by HERODOTUS, and other ancient writers; whatever that bird may have been (comp. above, p. 413), so much is certain, that it was not the *Trochilus* of Zoologists, and that this name was given quite incorrectly to this genus of small American birds. They are in all respects formed for flying, and are almost always in motion, like the swallows, which have much analogy with the humming-birds. They lay two eggs in a nest which is composed principally of the woolly tissue of plants.

LINNÆUS counted in 1766 two and twenty species of his genus *Trochilus;* between two and three hundred are now known. Within the last few years, therefore, different genera have been proposed to distinguish the species, especially by SWAINSON and GOULD. They are founded chiefly upon the form and relative length of the bill and of the tail.

† *With bill curved.*

Phaethornis SWAINS. Bill elongate, curved, compressed at the sides, acute. Tail long, cuneate, with two middle feathers produced. Tarsi feathered.

Sp. *Trochilus superciliosus* L., BUFF. *Pl. enl.* 600, fig. 3, LESSON *Colibr.* Pl. 6, 7; Brasil, &c.

Oreotrochilus GOULD. Bill scarcely longer than head, moderately curved. Tail rounded, with feathers attenuated. Tarsi feathered.

Sp. *Trochilus Estella* D'ORBIGNY, GOULD *Trochilid.* Pl. 2;—*Trochilus Jamesonii* JARDINE, *Trochilus Pichincha* BOURRIER, GOULD l. l. Pl. 19, JARDINE *Contrib. to Ornith.* 1850, Pl. 43, Peru &c. These species live on high mountains close to the line of permanent snow.

Polytmus BRISS., GRAY. Bill elongate. Tail broad, rounded. Tarsi partly feathered.

Sp. *Trochilus mango* L., BUFF. *Pl. enl.* 680, figs. 2, 3, LESS. *Colibr.* Pl. 13—15; from the West Indies, &c.

Trochilus GRAY, GOULD, (add *Topaza* GRAY). Bill moderately curved, elongate. Tail emarginate, with two lateral feathers sometimes very long. Tarsi short, partly feathered.

Sp. *Trochilus Polytmus* L., *Ornismya cephalatra* (sic) LESSON *Ois. mouch.* Pl. 17, GOULD l. l. Pl. 1; Jamaica;—*Trochilus Pella* L., BUFF. *Pl. enl.* 599, fig. 1, LESS. *Ornith.* Pl. 73, fig. 1, *Colibr.* Pl. 2—5; Guyana, &c.

†† *With bill straight.*

Mellisuga BRISS., GRAY, *Orthorhynchus* LACEP., LESS. (excl. of some species.)

Sp. *Trochilus minimus* L., *Hylocharis nigra* GRAY, BRISS. *Ornith.* III. Pl. 35, figs. 1, 8, BUFF. *Pl. enl.* 276, fig. 1, LESS. *Ois. mouch.* Pl. 79, GOULD l. l. Pl. 30; at St Domingo; this extremely small bird is only 2 inches 3 lines long from the tip of the bill to the end of the tail.

To the straight-billed humming-birds, which the French Zoologists name *Oiseaux mouches*, belong a still greater number of species than to the preceding division. The bill is of very various lengths in some even shorter than the head, and awl-shaped, as *Ornismya Lindenii* PARZUDAKI, GUÉR. *Revue et Mag. de Zool.* 1849, Pl. 8, *Oxypogon Lindenii* GOULD l. l. Pl. 13;—*Ornismya microrhyncha* BOISSONNEAU, GUÉR. *Magas. de Zool.* 1840, *Ois.* Pl. 16; in most longer than the head, as, *Trochilus sparganurus* SHAW, *Ornismya Sappho* LESS. *Ois. mouch.* Pl. 27, 28, *Cometes sparganurus* GOULD l. l. Pl. 47; in some as long even as the whole body, *Trochilus ensiferus*, *Ornismya ensifera* BOISSONN., GUÉR. *Magas. de Zool.* 1840, *Ois.* Pl. 15, *Docimastes ensiferus* GOULD l. l. Pl. 7. Here the bill is in some degree bent upwards; such is more decidedly the case in other species, of which the bill is less elongated, as *Trochilus recurvirostris*, *Campylopterus recurvirostris* SWAINS., LESS. *Ois. mouch.* Pl. 37, *Colibr.*, *Ois. m.*, *Suppl.* Pl. 34. and *Trochilus avocetta* LESS. *Colibr.*, *Ois. m.*, *Suppl.* Pl. 24, *Trochil.* Pl. 23.

Note.—Here also are to be referred sub-genera *Hylocharis* and *Heliothrix* BOIE, and several genera of GOULD, here omitted.

Rhamphodon Less., *Grypus* Spix, Gray. Bill elongate, with tip of upper mandible produced, curved. Margins of bill serrate anteriorly with denticles recurved. Tail graduated, rounded.

Sp. *Trochilus nævius* Dumont, Temm. *Pl. col.* 120, fig. 3, *Rhamphodon maculatum* Less. *Colibr.* Pl. 1; Brasil.

Family XXXIV. *Anabatidæ* Cabanis. Primaries ten, with first short. Wings moderate or short. Wing-coverts mostly covering less than half of the secondaries. Two outer toes conjoined at the base. Tarsi covered anteriorly with transverse scutes, often produced on the sides and posteriorly so as to leave only a narrow reticulate line. Bill of various form and size, acuminate at the tip, compressed.

Dendrocolaptes Hermann[1]. Bill elongate or moderate, depressed at the base, acuminate at the tip, compressed, mostly curved. Gape of mouth large. Nostrils lateral, placed in a pit at the base of bill. Two outer toes subequal, longer than inner. Claws compressed, curved. Wings with first quill short, third, fourth and fifth subequal, fourth mostly longest of all. Tail with feathers pointed, the stem being naked and acute at the extremity.

To this genus different species belong, all from South America, which form a small group presenting many differences especially in the bill. Compare on this, published in different numbers of Guérin's *Revue et Magas. de Zool.* 1850, 1851, *Monographie du genre Picicule, par* De Lafresnaye.

† *With bill compressed.*

Xiphorhynchus Swains. Bill slender, very much elongated, curved.

Sp. *Dendrocolaptes trochilirostris* Lichtenst., *Dendrocopus falcularius* Vieill., *Gal. des Ois.* Pl. 175;—*Dendrocol. procurvus* Temm. *Pl. col.* 28;—*Dendr. Pucheranii* Lafresn., Desmurs *Pl. peint.* 68.

Dendrocolaptes Swains. (and *Picolaptes* Less., Lafresn.) Bill elongate, moderately curved.

Sp. *Dendrocolaptes major* Lafresn. (*Dendr. rubiginosus* previously), Guér. *Mag. de Zool.* 1833, *Ois.* Pl. 10;—*Dendrocolaptes tenuirostris* Licht., *Picolaptes guttatus* Less. *Cent. Zool.* Pl. 32, &c.

Nasica Less., Lafresn. Bill elongate, almost straight, with tip alone curved or hooked.

Sp. *Dendrocolaptes longirostris* Illig., Levaill. *Promer.* Pl. 24; *Dendrocolaptes xanthogaster*, *Dryocopus flavigaster* Desmurs, *Pl. peint.* Pl. 52.

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[1] *Observat. Zoolog.* Argentorati, 4to. p. 135.

Dendroplex SWAINS. Bill moderate, straight, much compressed, conical.

Sp. *Dendrocolaptes picus, Oriolus picus* GM., BUFF. *Pl. enl.* 605;—*Dendrocolaptes picirostris* DESM. *Pl. peint.* 51 (incorrectly 53).

Sittasomus SWAINS. Bill short, straight. Posterior claw longer than hallux, slender, somewhat straight.

Sp. *Dendrocolaptes erythacus* LICHTENST., *Dendroc. sylviellus* TEMM. *Pl. col.* 72, fig. 1.

†† *With bill depressed, at the base broader than high.*

Premnocopus CABANIS, *Dendrocops* SWAINS.

Sp. *Dendrocolaptes cayennensis, Gracula cayennensis* GM., BUFF. *Pl. enl.* 621, LESS. *Ornith.* Pl. 62, fig. 2; *Dendrocolaptes platyrostris* (sic!) SPIX *Av. Bras.* Tab. 89.

Dendrocincla GRAY, CAB., *Dryocopus* MAX. NEOVID.

Sp. *Dendrocolaptes Perrotii* LAFRESN., *Mag. de Zool.*, 1844, *Ois.* Pl. 54, &c.

Note.—On some other sub-genera, omitted here, consult GRAY *Gen. of Birds*, Vol. I. and LAFRESNAYE l. l.

Furnarius VIEILL., *Opetiorhynchus* TEMM., *Figulus* SPIX. Bill moderate or longer than head, slender, compressed, moderately curved or somewhat straight. Nostrils basal, lateral, partly covered by membrane. Tarsi long. Outer toe much shorter than middle. Wings with third and fourth quills subequal, fourth longest of all. Tail graduated, rounded.

Sp. *Furnarius figulus, Turdus figulus*, ILLIG., BUFF. *Pl. enl.* 739;—*Furnarius rufus, Merops rufus* GM., *Figulus albogularis* SPIX *Av. Bras.* Tab. 70, &c. Birds of Brasil, placed formerly in the neighbourhood of *Nectarinia;* they construct a nest of clay, of which the form has been compared to a baker's oven, and which is divided into two cavities; in the lower cavity the female lays four white, red-spotted eggs upon some grass.

Cillurus CABANIS, *Cinclodes* GRAY.

Sp. *Furnarius chilensis* LESS., *Motacilla patagonica* GM., *Opetiorhynchus rupestris* KITTL., LESSON *Ornith.* Pl. 75, fig. 1, KITTL. *Vögel von Chili, Mém. des Sav. étrang. prés. à l'Ac. de St Pétersbourg*, I. 1831, Tab. VIII.

Lochmias SWAINS., *Picerthia* ISID. GEOFFR. ST.-HIL. Bill moderate, slender. Nostrils lateral, linear. Wings short, with third, fourth and fifth quills subequal, fifth longest of all.

Sp. *Furnarius sancti Hilarii* LESS., *Ornith.* p. 307, ISID. GEOFFR. *Nouv. Ann. du Mus.* I. 1832, p. 392.

Genus *Sclerurus* SWAINSON, is this its place?

Add genera *Geositta* SWAINS., *Henicornis* GRAY and *Ochetorhynchus* MEYEN, on which cons. GRAY *Gen. of Birds*, I.

Xenops HOFFMANNSEGG[1], *Neops* VIEILL. Bill moderate or short, compressed, with culmen straight; lower mandible ascending towards the tip. Middle toe longer than the laterals; claw of hallux larger than the anterior toes. Wings with fourth quill longest. Tail moderate, with feathers lax.

Sp. *Xenops genibarbis* TEMM., *Pl. col.* 150, fig. 1;—*Xenops rutilans* TEMM., *Pl. color.* 72, fig. 2;—*Xenops rufosuperciliaris* (!) LAFRESN., GUÉR. *Magas. de Zool.* 1832, *Ois.* Pl. 7, &c. All these species are Brasilian.

Anabates TEMM. (*Syniallaxis* VIEILL., TEMM.) Bill shorter than head, compressed, acuminate, with culmen moderately bent towards the tip; lower jaw straight. Nostrils basal, lateral, oblong, narrow. Tarsi covered with a row of large scutes produced to the sides. Claw of hallux larger than the anterior middle claw. Tail elongate, graduated, with feathers flexile. Wings short, with third, fourth and fifth quills subequal, longest.

Sp. *Anabates amaurotis* TEMM., *Pl. col.* 238, fig. 2;—*Anabates macrourus* MAXIM., *Anabates striolatus* TEMM. l. l. fig. 1, &c.

Sub-genus: *Synallaxis* VIEILL. Bill short, slender. Tarsi slender, elongate.

Sp. *Synallaxis phryganophila* VIEILL., *Synallaxis tessellata* TEMM., *Pl. col.* 311, fig. 1, GUÉRIN *Iconogr., Ois.* Pl. 23, fig. 2;—*Synallaxis ruficapilla* VIEILL. *Galer.* Pl. 174, *Synall. albescens* TEMM. *Pl. col.* 227, fig. 2, CUV. *R. Ani., éd. ill., Ois.* Pl. 40, fig. 4; *Synallaxis Tupinierii* LESS., *Motacilla spinicauda* GM., LESS. *Ornith.* Pl. 74, fig. 2, &c.

Oxyrhamphus STRICKL., *Oxyrhynchus* TEMM.

Note.—To this family also are to be referred genera *Sphenopyga* CABAN. (*Anumbius* LAFRESN.), *Thripophaga* CABAN. and *Schizura* ejusd. (*Sylviorthorhynchus* DESMURS.)

Sp. *Schizura maluroides, Sylviorthorynchus Desmurii*, DESM. *Pl. peintes* 45.

Family XXXV. *Eriodoridæ* CABANIS. Wings short, with ten primaries. Cubital coverts short. Tarsi covered anteriorly with a row of large scutes, posteriorly with a double row of scutes

[1] ILLIG. *Prodrom.* p. 213.

or with reticulate scales. Feathers of back between the wings and at the base of tail mostly elongate, lax, soft, as though of silk. Tail with feathers various in number. (Bill straight, with tip bent.)

In this and in the preceding family, as we learn from the investigations of MUELLER, the lower *larynx* is not formed by the *bronchi* but only by the lowest part of the *trachea*. To this division of birds he gave in consequence the name of *Tracheophones*. *Abhandl. der Akad. der Wissensch. zu Berlin*, 1845, s. 357—365.

Section I. *Menurinæ*.

Menura DAVIES, LATH. Bill moderate, keeled, broad at the base. Nostrils placed in a lateral fossa, covered by membrane, elongate. Orbital region naked. Tarsi long, covered behind at the upper part with smaller scutes, below reticulate. Claws strong, curved, elongate; claw of hallux longer than the rest. Wings short, with first five quills gradually longer, sixth, seventh, eighth and ninth subequal, longest of all. Tail elongate, in male erect, with 16 feathers, most of them lax, in female cuneate, with 12 feathers.

Sp. *Menura superba* DAVIES, *Menura Lyra* SHAW, DAVIES *Linn. Trans.* VI. 1801, pp. 207—210, Tab. 22, GUÉRIN. *Iconogr., Ois.* Pl. 13, fig. 2, LESS. *Ornith.* Pl. 88; the outer tail-feathers are curled outwards and ornamented with ruddy spots;—*Menura Alberti* GOULD, JARDINE *Contrib. to Ornith.* 1850, Pl. 50; a species discovered not long ago, with shorter tail; the outer tail-feathers are shorter than those that succeed to them internally. Both species are large, shy birds of New Holland, which feed on insects, particularly beetles, and on land-slugs. Comp. JULES VERREAUX *Notes sur les mœurs*, &c. *du Menura superba* GUÉR. *Revue et Magas. de Zool.* 1849, pp. 113—116.

Section II. *Myiotherinæ*.

Pteroptochus KITTLITZ. Bill moderate, straight, with culmen obtuse, curved. Nostrils basal, lateral, covered by a horny operculum. Bristles at the base of bill and around the eyes. Feet strong; tarsus equalling middle toe or exceeding it a little; lateral toes equal; hallux elongate. Claws curved, strong. Wings short, rounded, with third and fourth quills and on to the seventh subequal, longest of all. Tail moderate, graduated.

Sp. *Pteroptochus rubecula* KITTL., *Mém. présentés à l'Acad. des Sc. de St Pétersbourg*, I. 1830, p. 179, Tab. 11;—*Pteroptochus albicollis* KITTL. ib. p. 180, Tab. III. *Megalonyx medius* LESSON, *Illustr. de Zool.* Pl. 60.

Chamæa GAMBEL.

Sp. *Chamæa fasciata*, GAMBEL *Journal of Acad. of nat. Sc. of Philadelphia, Sec. Ser.* Vol. I. Pl. 8, fig. 3.

Hylactes KING, *Megalonyx* LESS. in part. Bill short, with culmen curved, compressed towards the tip, emarginate. Nostrils basal, covered by a vaulted membrane, narrow. Tarsi longer than anterior toes. Claws long. Wings short, with fourth and fifth quills subequal, longest of all. Tail rounded, with 14 feathers.

Sp. *Hylactes Tarnii* KING, *Proceed. Zool. Soc.* 1830, p. 15;—*Hylactes rufus, Megalonyx rufus* LESSON *Centur. Zool.* Pl. 66; both from Chili.

Colobatris GLOGER, CABANIS, *Grallaria* VIEILL. Bill short or moderate, strong. Wings concave, with first quill short, fourth and fifth subequal, longest of all. Tarsi elongate, covered posteriorly with lesser scutes, sometimes externally with scute continuous. Tibiæ denuded above the heel. Outer toes united. Tail very short.

Sp. *Colobatris rex, Turdus rex* GM., *Grallaria varia* GRAY, BUFF. *Pl. enl.* 702, *Grallaria fusca* VIEILL., *Galer.* Pl. 154; Brasil;—*Colobatris tinniens, Turdus tinniens* GM., *Grallaria brevicauda* GRAY, BUFF. *Pl. enl.* 706, fig. 1, &c.

Sub-genera *Hypsibenon* CABANIS and *Chamæza* VIGORS (*Chamæzosa* CABAN.)

Pitta VIEILL., GRAY, *Brachyurus* THUNB. Bill moderate, strong, broad at the base, compressed towards the tip, emarginate, with culmen keeled, curved. Nostrils lateral placed in a pit, half covered by membrane. Tarsi elongate, slender, obscurely scutellate posteriorly. Lateral toes short. Wings with third and fourth quills longest of all. Tail very short, even.

Sp. *Pitta brachyura* TEMM., *Corvus brachyurus* L., BUFF. *Pl. enl.* 258, CUV. *R. Ani., éd. ill., Ois.* Pl. 25, fig. 1;—*Pitta cyanoptera* TEMM. *Pl. color.* 218;—*Pitta Baudii* S. MUELLER, *Verh. over de natuurlijke Gesch.* &c., *Aves*, Tab. II. The last named species is from Borneo, the one preceding from Sumatra, the first from the continent of India. This genus of the old world comprises other species, amongst which is one from the west coast of Africa, *Pitta angolensis* VIEILL., DESM. *Pl. peint.* 46. These birds make a rude nest of roots, leaves and straw, in which they lay four or five white or light-yellow eggs. See *Verhandelingen*, &c. I. 1. Tab. III.

Myiothera ILLIG. (in part), *Myrmothera* VIEILL. (and spec. of *Myoturdus* MAXIM., *Formicarius* BODD., GRAY). Bill moderate, compressed, emarginate, with culmen curved. Tarsi long, scutellate posteriorly. Wings with fourth and fifth quills subequal, longest of all. Tail short, rounded.

Compare on this genus and this entire family MÉNÉTRIÉS *Monographie de la famille des Myiotherinæ, Mém. de l'Acad. de St Pétersb.* VIe Série, Tome VI. *Sc. mathém. et nat.*, 1835, pp. 443—543.

a) *With outer toes concrete at the base only.*

Myiothera auctor.

Sp. *Myiothera colma, Turdus colma* GM., BUFF. *Pl. enl.* 703, fig. 1;—*Myiothera tetema, Turdus cayennensis?* and *Turdus colma* var. β GM., &c.

b) *With outer toes united together.*

Conopophaga VIEILL. Bill short, depressed at the base.

Sp. *Myiothera lineata* MAXIM., *Conopophaga vulgaris* MÉNÉTR. l. l. Pl. 14;—*Myiothera aurita, Turdus auritus* L., BUFF. *Pl. enl.* 822.

Pithys VIEILL. Outer toes free at the apex only. Tarsi covered on the outside with a horny scute, on the inside with naked skin.

Sp. *Myiothera albifrons* LICHTENST., *Pipra albifrons* GMEL., *Pithys leucops* VIEILL., *Dasycephala albifrons* SWAINS., GRAY, BUFF. *Pl. enl.* 701, fig. 1, VIEILL. *Galer. des Ois.* Pl. 129, &c.

Formicivora SWAINS., GRAY. Bill moderate, acuminate. Wings somewhat short, rounded, with fifth and sixth quills subequal, longest of all. Outer toes conjoined at the base only. Tail somewhat long, graduated.

Sp. *Formicivora grisea* STRICKL., *Motacilla grisea* GM., *Formicivora leucophrys* GRAY, BUFF. *Pl. enl.* 643, fig. 1, &c.

Thamnophilus VIEILL. (exclus. of some species;—species of *Lanius* auctor.) Bill strong, compressed, with tip of upper mandible hooked, emarginate before the hook. Tarsi moderate, covered posteriorly and on both sides with small scutes. Outer toes conjoined at the base only. Wings with fourth, fifth and sixth quills subequal, fifth mostly longest of all. Tail long, graduated, with feathers rounded.

Sp. *Thamnophilus doliatus* VIEILL., *Lanius doliatus* L., BUFF. *Pl. enl.* 297, fig. 2, &c.; South American species, mostly of the size of a starling, some larger, as *Thamnophilus striatus* QUOY and GAIM., *Thamnophilus gigas* SWAINS., *Voyage de l'Uranie, Ois.* Pl. 18, 19.

Family XXXVI. *Colopteridæ* CABANIS, *Cotingidæ* BONAP. Wings moderate, with ten primaries; some of the first quill-feathers mostly narrowed towards the point, or the second in males imperfect, abbreviate. Cubital coverts short. Tarsi covered anteriorly

with scutes, posteriorly with naked skin or scales. Bill mostly short, depressed at the base, often emarginate at the tip; gape of mouth ample.

Tityra VIEILL., GRAY, *Psaris* CUV.[1] Bill shorter than head, strong, with culmen rounded, curved. Nostrils lateral, rounded, half-covered with short bristles. Wings with third and fourth quills subequal, longest of all; second quill in adult males short, imperfect. Outer toes conjoined at the base. Claws compressed, curved. Tail moderate, even or rounded.

Sp. *Tityra cayana* GRAY, *Lanius cayanus* L., *Tityra cinerea* VIEILL., BUFF. *Pl. enl.* 304, 377, LESSON *Ornith.* Pl. 47, fig. 2, VIEILL. *Gal.* Pl. 134; whitish-grey, head, wings and tail black, Guiana;—*Tityra valida, Tityra atricapilla* VIEILL., *Lanius validus* LICHTENST., *Tityra leuconota* GRAY *Gener.* Pl. LXIII. Brasil; of this last and some other species CABANIS forms the genus *Pachyrhamphus* (GRAY), a name regarded by GRAY as synonymous with *Tityra*.

Bathmidurus CAB.

Sp. *Tityra atricapilla, Lanius atricapillus* GM.

Tyrannus CUV. (Sp. of *Lanius* and *Musicapa* L.) Bill of various length, with tip hooked. Nostrils basal, lateral. Long bristles at the angle of mouth. Wings of males with the first (three) quills narrowed towards the extremity, the third or fourth mostly longest of all. Tarsi covered with transverse scutes, large, produced beyond the outside posteriorly, with naked skin on the inner surface. Outer toes conjoined at the base. Claws compressed, curved. Tail in some even, broad towards the apex, forked in some.

Scaphorhynchus MAXIM. Bill a little longer than head, broad at the base, inflated at the margin. Wings with second quill longest. Tail even.

Sp. *Tyrannus pitangua* CUV., *Lanius pitangua* L., *Scaphorhynchus sulfuratus* MAXIM., BUFF. *Pl. enl.* 212, CUV. *R. Ani., éd. ill., Ois.* Pl. 17, fig. 1, Brasil.

Saurophagus SWAINS., *Apolites* SUNDEV. Bill of the length of head, straight, with culmen rounded, acute, with sides straight. Wings with third, fourth and fifth quills subequal, fourth longest of all.

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[1] *Psaris*, a Greek name of a bird, according to CUVIER; perhaps he meant *ψαρός*, and it ought then to be *Psarus;* but LATREILLE had already a genus *Psarus* amongst the *Diptera* (I. p. 326). Of *Tityra* the etymology is unknown to me, but the name, as more commonly received, it seems necessary now to retain.

Sp. *Tyrannus sulphuratus* CUV., *Lanius sulphuratus* L., BUFF. *Pl. enl.* 296, LESSON *Ornith.* Pl. 42, fig. 2.—*Tyrannus lictor, Lanius lictor* LICHTENST., GRAY *Gener.* Tab. LXII.

Milvulus SWAINS., *Muscipipra* LESS. Bill shorter than head, compressed at the tip. Wings with second or third quill longest of all. Tail forked, with outer feather on both sides very long.

Sp. *Tyrannus savana* VIEILL., *Musicapa tyrannus* L., BUFF. *Pl. enl.* 571, fig. 2, BONAPARTE *Continuation of* WILSON'S *Americ. Ornith.* Pl. 1, fig. 1 (JARDINE'S edit. III. pp. 261—266); in North and South America, &c.

Tyrannus GRAY, *Drymonax* GLOGER. Bill in some longer than head, in some shorter, with culmen rounded, the margins turned obliquely outwards. Wings with second and third quills subequal, third longest of all. Tail emarginate, broad at the apex. (First two feathers sinuate at the extremity.)

Sp. *Tyrannus intrepidus* VIEILL., *Lanius tyrannus* L., (in part) BUFF. *Pl. enl.* 676, WILSON *Amer. Ornith.* Pl. 13, fig. 1; grey, white below, tail greyish-black with white posterior margin; on the top of the head a yellow or reddish spot. This courageous bird, of the greatest service by killing insects, is named in North America *King-bird;* compare on its economy WILSON (JARDINE'S edit.) I. pp. 216—225;—*Tyrannus matutinus* VIEILL. (*Lan. tyrannus* L., in part), BUFF. *Pl. enl.* 537, &c.

Myriarchus CABAN. (*Tyrannula* SWAINS. in part, *Myiobius* GRAY in part, add *Pyrocephalus* GOULD, GRAY). Bill depressed, with culmen keeled. (First quill-feathers scarcely or not at all sinuate. Tail subeven. Other characters of sub-genus *Tyrannus.*)

Sp. *Tyrannus ferox, Muscicapa ferox* GM., BUFF. *Pl. enl.* 571, fig. 1;—*Tyrannus virens, Muscicapa virens* L., *Muscicapa rapax* WILSON l. l. Pl. 13, fig. 5;—*Tyrannus virgatus, Muscicapa virgata* GM., *Muscicapa flammiceps* TEMM. *Pl. col.* 144, fig. 3, &c.

Muscivora CUV. (*Muscipeta* ejusd. previously) in part, GRAY. Bill moderate, broad at the base, depressed, narrowed towards the hooked tip, with culmen depressed. Nostrils basal, lateral. Long, rigid bristles at the angle of mouth. Wings with third and fourth quills subequal, longest of all. Tail long, subeven. Tarsi short, covered anteriorly with scutes obsoletely distinct.

Sp. *Muscivora regia, Todus regius* GM., *Megalophus regius* SWAINS., BUFF. *Pl. enl.* 289, *Dict. univ. d'Hist. nat., Ois.*, Pl. 2;—(*Muscivora cristata* GRAY, *Todus cristatus* BODD., *Naturforscher* XVII. Pl. 1.?)—*Muscivora ferruginea* CABAN., *Muscivora rupestris* GRAY (and *Platyrhynchus ferrugineus* ejusd.) &c.

Note.—On some other sub-genera to be referred to *Tyrannus* or *Muscivora*, omitted here, cons. GRAY *Gener.* (*Muscicapinæ* and *Tyranninæ*) and CABANIS *Archiv für Naturgesch.* 1847, pp. 247—251.

Platyrhynchus DESMAR., VIEILL. Bill short, depressed, equalling the forehead in breadth, emarginate at the tip. Gape of mouth produced below the eyes. Nostrils basal, superior. Long bristles at the angle of mouth. Tarsi longer than middle toe; outer toes conjoined at the base. Wings with third, fourth and fifth quills subequal, fourth and fifth longest of all. Tail short, even.

Sp. *Platyrhynchus fuscus* VIEILL., *Todus platyrhynchus* GM., PALL. *Spic. Zool.* VI. Tab. 3, fig. c (fig. of bill), VIEILL. *Gal.* Pl. 126, LESS. *Ornith.* Pl. 32, fig. 2;—*Platyrhynchus cancromus* TEMM. *Pl. col.* 12, fig. 2; Brasil, &c.

Todus L. Bill moderate, subulate, depressed, with culmen distinct, with tip rounded and obtuse, surrounded at the base by large bristles. Nostrils placed in back of bill before the base. Wings short, with first two quills short, narrowed, fourth longest of all. Outer toes united, free at the extremity only. Tail short, rounded.

Sp. *Todus viridis* L., BUFF. *Pl. enl.* 585, figs. 1, 2, VIEILL. *Galer.* Pl. 124; under this name, according to LAFRESNAYE, two species are included; one of Jamaica, to which he would appropriate the name *Todus viridis* exclusively, the other of St Domingo, *Todus Dominicensis* LAFRESN., to which the figures referred to belong (*Revue Zoologique par* GUÉRIN, 1847, pp. 326—333). Perhaps *Todus subulatus* GOULD (GRAY *Gen.* Tab. XXII.) is not specifically different from this last.

Triccus CABANIS, *Todirostrum* LESS. Bill somewhat short, with tip hooked, emarginate. Tail cuneiform. (Other characters nearly of the preceding genus, but outer toes less concrete.)

Sp. *Triccus cinereus, Todus cinereus* L., BUFF. *Pl. enl.* 525, fig. 3;—*Triccus diops, Muscicapa diops* TEMMINCK, *Pl. col.* 144, fig. 1, &c.

Add: *Euscarthmus* MAXIM., *Hapalura* CABAN., *Orchilus* CAB., *Hapalocerus* (*Lepturus* SWAINS.), *Colopterus* CABAN.

On these genera conjoined with *Todus*, cons. CABANIS in TSCHUDI *Fauna Peruan., Ornith.* pp. 163—166, and *Archiv f. Naturgesch.* 1847, pp. 251—254. *Colopterus* is distinguished by the tail even, the tarsi somewhat long and especially by the first three quill-feathers short and narrow. Sp. *Colopterus cristatus* CABAN., *Archiv f. Naturg.* l. l. Tab. v. fig. 2, &c.

Fluvicola SWAINS., GRAY, *Entomophagus* MAXIM. (Add *Xolmis* BOIE, CABAN., *Tænioptera* BONAP.). Bill moderate or shorter than head, with culmen rounded, tip emarginate. Nostrils basal, lateral. Tarsi longer than middle toe. Outer toes conjoined at the base.

Wings long, with third and fourth quills (sometimes second also) subequal, third longest of all.

Sp. *Fluvicola pica* GRAY, *Muscicapa bicolor* GM., BUFF. *Pl. enl.* 566, fig. 3, ,, 675, fig. 1, Cayenne; white, except the neck, wings and tail, which are black.—*Fluvicola cursoria* SWAINS., *Muscicapa climacura* VIEILL., &c.

Xenurus BOIE, *Alectrurus* VIEILL. Bill short, conical, with the culmen rounded. Long bristles at the angle of mouth. Tarsi long. Wings long, with first or first two quills sinuate at the point in males, third longest of all. Tail in some erect, supported by setaceous feathers, in some with two feathers elongate, the stem naked, vaned at the apex. Claw of middle toe and of hallux long, curved, acute.

Sp. *Xenurus alector, Alectrurus tricolor* VIEILL., *Muscicapa alector* MAXIM., TEMM. *Pl. color.* 155;—*Xenurus psalis* nob., *Muscicapa psalura* TEMM., *Muscicapa risora* (sic) VIEILL., *Galer.* Pl. 131, TEMM. *Pl. col.* 286, 296; both species from Brasil.

Add genera of modern writers allied to the *Fluvicolæ: Copurus* STRICKL., *Ochthoeca* CABAN., *Centrites* ejusd., *Ptyonura* GOULD, *Agriornis* GOULD and some others, on which consult GRAY *Gener. of Birds* and CABANIS *Arch. f. Naturgesch.* 1847, pp. 254—256 and p. 340.

Calyptura SWAINS., GRAY. Bill short, emarginate, with culmen arched towards the tip. Nostrils basal, lateral, rounded. Wings rounded, with third, fourth and fifth quills longest of all. Tarsi slender, elongate. Outer toes conjoined at the base. Tail very short, almost concealed.

Sp. *Calyptura cristata* SWAINS., *Pardalotus cristatus* VIEILL, GUÉR. *Iconogr., Ois.* Pl, 7, fig. 1; Brasil.

Pipra L. Bill short, subtrigonal, broad at the base, curved at the tip, compressed, emarginate. Nostrils basal, lateral, partly covered by the feathers of forehead. Tarsi longer than middle toe; toes short; two outer concrete at the base, free at the point only. Wings with third and fourth quills longest of all. Tail short.

Sp. *Pipra pareola* L., BUFF. *Pl. enl.* 687, fig. 2 (adult male), Pl. 303, fig. 2 (young male), LESSON *Ornith.* Pl. 51, fig. 1;—*Pipra erythrocephala* L., BUFF. *Pl. enl.* 34, fig. 1; GUÉRIN *Icon., Ois.* Pl. 16, fig. 2, &c. Small South American birds, of which the males have lively and gaudy colours, mostly the head red, whilst the females have a greyish-green, single coloured plumage. In some species the two middle tail-feathers, especially in adult males, are elongated; they have the first four or five flag-feathers narrow and bent. Of these species CABANIS forms the genus *Chiroxiphia*. In others

the narrow flag-feathers are present, but not the elongated feathers of the tail (*Chiromachæris* CABAN.). CABANIS restricts the genus *Pipra* to those species of which the first flag-feathers are not narrowed and none of the tail-feathers elongated. To this division belongs *Pipra erythrocephala* L. (see above), *Pipra aureola* L., BUFF. *Pl. enl.* 34, fig. 3, &c.

Piprites CABAN., (and *Hemipipo* ejusd.). In the outer toes less concrete, the tail somewhat long, and in habit receding from the type of genus *Pipra*.

Sp. *Pipra pileata* NATTERER, TEMM. *Pl. col.* 172, fig. 1;—*Pipra chloris* NATT., TEMM. l. l. fig. 2.

Add sub-genera: *Jodopleura* LESS., *Calyptura* SWAINS., *Metopia* SWAINS. and *Phœnicocercus* SWAINS.

Rupicola BRISS., *Orinus* NITZSCH. (Sp. of *Pipra* L.) Bill moderate, compressed, curved, with gape large, covered at the base by decomposed plumes; upper mandible emarginate at the tip, produced beyond the tip of lower. Nostrils lateral, basal, concealed under feathers. Orbicular crest, erect, compressed, composed of lax feathers, extending from the base of bill over the head. Tarsi strong, covered anteriorly with large scutes. Outer toes conjoined. Wings long, with fourth and fifth quills subequal, longest of all, first quill in males abruptly narrowed. Tail broad, moderate.

Sp. *Rupicola cayana* SWAINS., *Pipra rupicola* L., BUFF. *Pl. col.* 39 male, 747 fem., LESS. *Ornith.* Pl. 51, fig. 2, GUÉR. *Icon., Ois.* Pl. 16, fig. 1, VOSMAER *Beschrijving van den Amerikaanschen Rotshaan*, Amsterdam 1769, 4to.;—*Rupicola peruviana, Pipra peruviana* LATH., BUFF. *Pl. enl.* 745.

Calyptomena RAFFL. Bill short, broad at the base. Feathers incumbent on the bill, continued in a short, compressed crest over the head. Wings broad. Tail short, even or somewhat rounded.

Sp. *Rupicola viridis, Calyptomena viridis* RAFFLES, HORSF., TEMM. *Pl. col.* 216, CUV. *R. ani., éd. ill., Ois* Pl. 60, fig. 2; Sumatra. All the other species of *Rupicola* hitherto known are American.

Ampelis L. (exclus. of some species.) *Cotinga* BRISS., GRAY. Bill short, broad at the base, with culmen subarcuate; upper mandible emarginate towards the tip, longer than lower. Nostrils lateral, partly closed posteriorly by membrane, with the plumules of the forehead continued up to the apertures of nostrils. Tarsi moderate, covered anteriorly with transverse scutes, posteriorly with small scales. Outer toes conjoined at the base only. Wings with first three or four quills subequal, second mostly (or in females fourth) longest of all. Tail moderate, even or subemarginate.

Sp. *Ampelis cotinga* L., *Cotinga cærulea* GRAY, BUFF. *Pl. enl.* 186; Brasil; male azure-blue, purple below, with black flag-feathers and black tail; female brown, greyish below.—*Cotinga cincta* GRAY, BUFF. Pl. 188, regarded by many writers as a variety, differs by a blue transverse streak on the breast;—*Ampelis cayana* L., BUFF. *Pl. enl.* 624, &c. In this species the first two flag-feathers are narrow.

Ampelis pompadora L., BUFF. *Pl. enl.* 279 male and 699 (fem. *Ampelis cinerea* auctor.); Cayenne, Guiana; the two mandibles more equal, the tail shorter, the first flag-feathers not narrowed. The male is purple coloured with white wings and stiff glossy coverts on the shoulders. This species is the type of the genus *Xipholena* GLOGER.

Pyrrhorhynchus LAFRESNAYE.

Comp. HARTLAUB, *Note Monographique sur le sous-genre Pyrrhorhynchus, Ampelis formosa* HARTL., GUÉR. *Revue et Magas. de Zool.* 1849, pp. 493, 494, Pl. 14, fig. 1.

Add *Ampelion* CABAN. (*Carpornis* GRAY), *Lipaugus* BOIE (*Lathria* SWAINS.).

Note.—The species of this genus differ from the allied species in their simple, unadorned plumage, whence the name *Lipaugus*. Bill moderate, deeply emarginate. Wings with first quill short, third and fourth subequal, longest of all. Sp. *Lipaugus simplex, Muscicapa simplex* LICHTENST., *Lipaugus lateralis* GRAY, *Gener.* Pl. LX. &c.

Ptilochloris SWAINS., *Collurampelis* LESS.

Sp. *Ptilochloris lunatus* SWAINS., *Lanius arcuatus* GEOFFR. SAINT-HIL., LAFRESN., GUÉRIN *Magas. de Zool.* 1833, *Ois.* Pl. 12.

Phibalura VIEILL.,[1] *Amphibolura* CABAN. Bill short, with culmen rounded, arched. Tarsi strong, covered anteriorly with transverse scutes. Outer toes scarcely conjoined at the base. Wing with first four quills longer than the rest, second and third subequal, longest of all. Tail forked, with outer feather on each side acute, produced.

Sp. *Phibalura flavirostris* VIEILL., *Galer.* Pl. 74, TEMM. *Pl. col.* 118, GUÉR. *Iconogr., Ois.* Pl. 9, fig. 2; Brasil. With the exception of the long forked tail, this bird has much resemblance to some species of *Ampelis* which form the sub-genus *Ampelion* CABAN. or *Carpornis* GRAY.

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[1] The etymology is uncertain; *phibalis* is the Greek name of a species of fig. It seems to me that *Psalidura* or *Schizura* would be better if these names were not already used in entomology. *Dicranura* appears, if there must be change, preferable to *Amphibolura*.

Threnoedus GLOGER, CABAN., *Querula* VIEILL. Bill moderate, or a little longer than head, strong, broad, inflated at the sides, narrowed at the tip, emarginate. Nostrils covered with recumbent plumes and bristles. Tarsi not longer than middle toe, covered anteriorly with scutes, reticulate posteriorly. Outer toes scarcely conjoined. Wings long, with second and third or third and fourth quills longest of all. Tail moderate, even, broad.

Sp. *Threnoedus militaris, Muscicapa militaris* GM., a large bird, carmine-red, with black wings and tail;—*Threnoedus rubricollis, Muscicapa rubricollis* GM., BUFF. *Pl. enl.* 381; both species from the tropical regions of the new world.

Chasmorhynchus TEMM. (*Procnias* of some writers). Head flat above, broad. Bill moderate, broad at the base, narrowed towards the tip, emarginate, with culmen distinct. Nostrils placed in a large fossa towards the middle of bill. Gape of mouth produced under the eyes. Tarsi covered anteriorly with scutes, reticulate posteriorly. Outer toes conjoined at the base. Wings long, mostly with third and fourth quills subequal, longest of all. Tail moderate, subeven.

Sp. *Chasmorhynchus variegatus, Ampelis variegata* GM., CUV. *Règne Ani.* 1817, Pl. 4, fig. 4, TEMM. *Pl. col.* 51, LESS. *Ornith.* Pl. 52, fig. 1; the male has the neck naked, with many pendant, vermiform lobes of skin; the head is light brown, the rest of the plumage white, with the exception of the wings, which are black;—*Chasmorhynchus carunculatus, Ampelis carunculata* GM., *Procnias nivea* GRAY, BUFF. *Pl. enl.* 793, 794, CUV. *R. Ani., éd. ill., Ois.* Pl. 26, fig. 2;—both species from Brasil.

Gymnoderus GEOFFR. Bill shorter than head, with culmen convex, acuminate at the tip, emarginate. Plumes of forehead short, silky, extending over the bill towards the nasal fossa. Orbital region and sides of neck destitute of feathers. Wings with third and fourth quills subequal, longest of all. Tail long, even, broad.

Sp. *Gymnoderus fœtidus, Gracula fœtida* L., *Corvus nudus* GM., BUFF. *Pl. enl.* 609, GUÉRIN *Icon., Ois.* Pl. 8, fig. 4; in Surinam and Guyana.

Coracina VIEILL. (except *Gymnoderus*). Bill strong, moderate or a little longer than head, somewhat depressed at the base, curved at the tip, compressed, emarginate. Nostrils large, oval, lateral, placed in a fossa. Rigid bristles at the base of bill. Gape of mouth large. Tarsi strong, covered anteriorly with scutes,

posteriorly reticulate. Wings long, with third and fourth or fourth and fifth quills longest of all. Tail broad.

a) *With bill moderate; tail somewhat long, rounded. Pyroderus* GRAY, *Coronis* GLOGER. Sp. *Coracina scutata* TEMM. *Pl. col.* 40, &c.

b) *With bill somewhat long; tail short, rounded; head shaded by erect plumes, deflected at the point. Cephalopterus* GEOFFR. Sp. *Coracina cephaloptera* VIEILL., *Cephalopterus ornatus* GEOFFR. SAINT-HILAIRE, *Ann. du Mus.* XIII. Pl. 15, LESSON *Ornith.* Pl. 41, fig. 2, GUÉR. *Iconogr., Ois.* Pl. 7, fig. 7; Brasil.

c) *With bill somewhat long. Tail short, even; head bald. Gymnocephalus* GEOFFR. Sp. *Coracina calva, Corvus calvus* GM., *Gymnocephalus capucinus* GEOFFR., BUFF. *Pl. enl.* 521, LESS. *Ornith.* Pl. 41, fig. 1, CUV. *R. Ani., éd. ill., Ois.* Pl. 18, fig. 2, Cayenne.

Phytotoma MOLINA, GM. Bill short, conical, with culmen rounded, margins serrate. Nostrils basal, small. Wings with third and fourth quills subequal, longest of all. Tarsi scutellate anteriorly. Tail somewhat long, even. (Genus of uncertain position.)

Sp. *Phytotoma rara* MOLINA, *Phytotoma sibens* V. KITL., *Phytotoma Bloxami* CHILDREN, GRAY *Gener.*, Pl. 95;—*Phytotoma rutila* VIEILL.;—*Phytot. angustirostris* D'ORBIGNY.

Compare on this genus MOLINA *Essai sur l'Hist. natur. du Chili*, Paris, 1789, 8vo, p. 234.—LEADBEATER *Linn. Transact.* XVI. 1829, pp. 85—87, —LAFRESNAYE in GUÉRIN *Magas. de Zool.* 1832, *Ois.* Pl. 2.—EYDOUX *et* GERVAIS, *sur quelques particularités anatomiques du Phytotoma*, ibid. 1838, *Ois.* Pl. 86, &c. This genus was placed formerly in the neighbourhood of *Fringilla.*

Family XXXVII. *Corvinæ.* Wings with ten primaries. Wing-coverts short. Tarsi covered anteriorly with transverse scutes, at the sides with integument continuous. Lateral toes equal, outer conjoined at the base alone. Bill strong, subconical, compressed at the tip, entire or emarginate obsoletely.

Corvus L. (exclus. of some species). Bill thick, cultrate, moderate or long. Nostrils basal placed in a fossa, concealed by recumbent bristles. Tarsi longer than middle toe, covered anteriorly with large transverse scutes. Wings with first quill moderate, third and fourth subequal, fourth, more rarely third, longest of all. Tail moderate, even or rounded. (Feathers strict, glossy. Bill and feet black.)

The *ravens.* These birds eat all sorts of food; they carefully hide the remains of their repast, in order to bring it to light again when they are

hungry; they pilfer also and hide any attractive objects, as pieces of money, children's toys, &c. They are social, cunning, and have a fine sense of smell. Most of the species lay four or five green, brown-spotted eggs in a nest consisting of dry twigs, filled in with earth and covered internally with hair, moss and straw.

Sp. *Corvus corax* L., LESS. *Ornith.* Pl. 35, fig. 1, NAUM. Taf. 53, fig. 1; the *raven, le corbeau, der Rabe;* the largest European species of this genus; it lives also in the North of Asia, and is rare with us (Holland); it lives principally in forests. In North America a similar species occurs (*Corvus corax* WILSON), another at Java (*Corvus corax* RAFFLES, *Corvus macrorhynchus* TEMM.).

Corvus corone L., BUFF. *Pl. enl.* 495, NAUM. Taf. 53, fig. 2; the *carrion-crow, der Krähen-Rabe, die Rabenkrähe;* this species also has a representative in North America in *Corvus americanus* AUDUBON, *Corvus corone* WILS.; —*Corvus cornix* L., BUFF. *Pl. enl.* 76, NAUM. Taf. 54, the *hooded-crow;* this species is grey with black head and tail and black wings, whilst the two first-named species are quite black with bluish-violet reflections.

Corvus monedula L., BUFF. *Pl. enl.* 522, 523, NAUM. Taf. 56, the *jack-daw,* is distinguished by a short bill. It builds its nest in our towns on towers, high roofs and chimneys. Here the third quill-feather is the longest. The same character is presented by an Asiatic species (occurring also in Japan), *Corvus dauricus* PALL., GRAY *Gen. of Birds* Pl. LXXVI. These species form the genus *Lycos* BOIE, *Monedula* BREHM.

In Africa a couple of species are found with very thick and high bill, in which the fourth quill of the wing is the longest. They have a white neck, but are otherwise quite black; *Corvus albicollis* LATH., and *Corvus crassirostris* RUEPPELL. Of these LESSON forms the genus *Corvultur.*

Pica BRISS. Bill moderate, curved. Wings with first quill short, often narrow, fourth, fifth and sixth subequal, longest of all. Tail elongate, cuneate.

Sp. *Corvus Pica* L., *Pica varia, Pica caudata* (WILLUGB., RAY), BUFF. *Pl. enl.* 488, LESS. *Ornith.* Pl. 35, fig. 2, NAUM. Taf. 56, fig. 2; the *magpie, la pie, die Elster;* a well-known bird, with snow-white shoulders and breast; the black feathers, especially of the tail, reflecting rich copper and steel-coloured tints; it likes to make its nest in fruit-trees, and lays 7 or 8 eggs.—*Corvus cyaneus* PALL., in Spain, also in Tartary and Japan, &c.

Caryocatactes CUV., *Nucifraga* BRISS. Bill subulate, a little longer than head, with tip obtuse, somewhat depressed. Incumbent bristles at the base of bill. Tarsi covered anteriorly with large transverse scutes. Wings with fourth and fifth quills subequal, longest of all. Tail rounded.

Sp. *Caryocatactes nucifraga, Corvus caryocatactes* L., BUFF. *Pl. enl.* 50, LESSON *Ornith.* Pl. 36, fig. 2, NAUM. Taf. 58, fig. 2; the *nut-cracker, le casse-noix, der Tannenheher, Nusshcher;* very rare in England; BREHM and

DE SELYS-LONGCHAMPS here distinguish two species, of which the one is characterised by a thicker and shorter bill; similar varieties however in the bill occur in other species; compare BERTHOLD, OKEN'S *Isis*, 1846, s. 726—730.

Psilorhinus RÜEPPELL. Bill moderate or a little longer than head, somewhat straight. Nostrils basal, lateral, open. Wings with fifth and sixth quills subequal, fifth longest of all. Tail long, graduated.

Sp. *Psilorhinus morio, Corvus morio* LICHTENST., *Pica fuliginosa* LESS., *Psilorhinus mexicanus* RUEPP. *Mus. Senck.* II. 1837, Taf. XI. fig. 2;—*Psilorhinus gubernator, Garrula gubernatrix* TEMM., *Cyanurus formosus* SWAINS., TEMM. *Pl. col.* 436, &c.

Add sub-genera *Cyanocorax* BOIE and *Cyanurus* SWAINS.

Calocitta (GRAY previously, in part) BONAP.

Sp. *Calocitta sinensis, Cuculus sinensis* L., *Corvus erythrorhynchus* GM., BUFF. *Pl. enl.* 622; from central Asia.

Garrulus BRISS. Bill shorter than head, thick, compressed, emarginate; lower mandible ascending to the tip, curved. Nostrils oval, basal, covered with recumbent plumes. Tarsi longer than middle toe. Wings with first quill short, fourth, fifth and sixth subequal, fifth longest of all. Tail somewhat long, even or rounded. (Head sub-crested. Coverts of back lax. Feathers variegated.)

Sp. *Garrulus glandarius, Corvus glandarius* L., BUFF. *Pl. enl.* 481, LESS. *Ornith.* Pl. 36, fig. 1, CUV. *R. Ani., éd. ill., Ois.* Pl. 38, fig. 3, NAUM. Taf. 38, fig. 1; the *jay, le Geai, der Heher, Eichelheher;* a prettily coloured bird, grey-ruddy, with a black spot under the eyes, and a blue patch with black transverse bars on the wings; the head is white above, with black stripes running longitudinally.

Perisoreus BONAP., GRAY, *Dysornithia* SWAINS. Bill short. Tail graduated.

Sp. *Garrulus infaustus, Lanius infaustus* L., BUFF. *Pl. enl.* 608, SUSEMIHL'S *Vögel Europ.* II. Tab. 6 *a*, fig. 2; grey-brown, the outer tail-feathers ruddy; in the North of Europe and in Asia;—*Garrulus canadensis, Corvus canadensis* L., BUFF. *Pl. enl.* 530, RICHARDSON *Faun. bor. Amer., Birds,* Pl. 55 (young, *Garrulus brachyrhynchus* SWAINS.)

Lophocitta GRAY, *Platylophus* SWAINS. Bill short, with tip curved, emarginate. Gape of mouth ample; long bristles at the

angle of mouth, Head crested. Wings with fourth and fifth quills subequal, longest of all. Tail graduated.

Sp. *Lophocitta galericulata* GRAY, *Lanius galericulatus* CUV., *Geai longup* LEVAILL., *Parad.* Tab. 42; Java. Another very similar species occurs at Borneo and Sumatra, *Lophocitta rufula* TEMM. *Mus. L. B.*

Dendrocitta GOULD. Bill moderate, curved, broad at the base, compressed at the sides towards the tip. Nostrils basal, lateral, concealed by short, crowded plumes. Claws curved, acute. Wings with fifth and sixth quills subequal, longest of all. Tail elongate, cuneate, with the two middle feathers produced.

Sp. *Dendrocitta leucogaster* GOULD, *Trans. Zool. Soc.* I. Pl. 12, p. 89, *Proceed. Zool. Soc.* 1833, p. 57;—*Dendrocitta occipitalis, Glaucopis occipitalis* S. MUELLER, *Tijdschr. voor nat. Gesch.* II. 1835, Pl. IX. fig. 1;—*Dendrocitta vagabunda, Coracias vagabunda* LATH. &c. These species live in the East of Asia in mountainous districts on trees.

Crypsirhina VIEILL., *Temia* VAILL. (*Temia* LESS. add *Temnurus* ejusd. not SWAINS.[1], Sp. of *Glaucopis* TEMM.)

Sp. *Crypsirhina varians* VIEILL., *Corvus varians* LATH., VIEILL. *Galer.* Pl. 106, GUÉR. *Iconogr., Ois.* Pl. 51, fig. 3, &c.

Callœas FORSTER, GRAY, *Glaucopis*. GMEL. Bill shorter than head, curved, thick, inflated at the sides. Tarsi exceedingly long. (Other characters almost of *Dendrocitta;* wings short.)

Sp. *Callœas cinerea, Glaucopis cinerea* GM., LESS. *Ornith.* Pl. 48, fig. 2, VIEILL. *Galer.* Pl. 93; greyish black, the female greenish grey; two lobes of skin under the bill; tail-feathers broad at the extremity, with a narrow pointed elongation of the shaft, which also occurs in *Dendrocitta vagabunda.* This species lives in New Zealand.

Note.—Add genera *Struthidea* GOULD, *Brachystoma* SWAINS., *Conostoma* HODGS., and *Ptilostomus* SWAINS. The last genus, allied to *Dendrocitta,* but African, is distinguished by the quill-feathers narrowed at the point and by the third, fourth and fifth subequal, longest of all.

Onychognathus HARTLAUB. Bill longer than head, with culmen arched, tip produced, hooked, acute. Wings moderate, the first bastard quill, the third, fourth and fifth subequal, longest of all.

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[1] See above, p. 449.

The greater wing-coverts with external barb duplicated, the inferior branches lax, decomposed. Tail elongate, graduate.

Sp. *Onychognathus fulgidus* HARTL., GUÉR. *Revue et Magas. de Zool.* 1849, Pl. 14, figs. 2, 3; habitat in the Island of St. Thomas on the coast of Guinea. I have not seen the bird.

Chlamydera GOULD. (*Callodera* previously.) Bill short, curved. Nostrils oval, basal, open. Wings with third, fourth and fifth quills subequal, fourth longest of all. Tail long, even, subdivaricate at the apex.

Sp. *Chlamydera maculata* GOULD, &c. Shy birds of New Holland; the species here noted is brown above with ferruginous spots, grey below with black wavy bands, whilst the male is ornamented with some red-violet, glossy, truncated feathers in the neck.

Ptilorhynchus KUHL. (Species of *Kitta* TEMM.) Bill short, high, curved, emarginate. Nostrils basal, covered entirely by curved feathers in males (in females partly covered). Wings with third, fourth and fifth quills subequal, fourth longest of all. Tail somewhat short, even.

Sp. *Ptilorhynchus holosericeus* KUHL, *Pyrrhocorax violaceus* VIEILL., TEMM. *Pl. col.* 395 male, 422 fem., LESS. *Ornith.* Pl. 46, fig. 1, male, &c. Birds of the size of *Corvus monedula*, which KUHL first characterised as a distinct genus, *Beiträge zur Zoologie*, Frankf. a. M. 1820, s. 150, 151. These are two species belonging to Australia, to which may be added another species of New Guinea, which is smaller, *Kitta buccoides* TEMM. *Pl. col.* 575.

Barita CUV. (*Cracticus* VIEILL.) Bill long, moderately curved, with culmen flat, the semicircular base produced amongst the feathers of the forehead, tip emarginate. Nostrils basal, open, narrow, linear, parallel to the margin of mandibles. Tarsi long, covered anteriorly with large elongated scutes, sometimes obsolete. Wings with third, fourth and fifth quills subequal, fourth mostly longest of all. Tail somewhat long, rounded, or subeven.

a) *Strepera* LESS., *Coronica* GOULD (add *Gymnorhina* GRAY).

Sp. *Barita strepera*, *Corvus strepera* LATH., *Corvus graculinus* WHITE, *Bot. Bay*, Pl. 36, p. 251, GUÉR. *Icon.*, *Ois.* Pl. 6, fig. 3—*Barita tibicen* QUOY et GAIM., *Gymnorhina leucota*, GRAY *Gen. of Birds*, Pl. LXXIII.;—*Barita anaphonensis* TEMM., *Gymnorhina anaphonensis* GRAY, LESS. *Ornith.* Pl. 47, fig. 1, &c.; species from New Holland.

b) *Cracticus* VIEILL., GRAY. (Bill curved, somewhat straight at the base, with tip hooked. Tail rounded.)

Sp. *Barita varia, Coracias varia* GM., *Cracticus cassicus* GRAY, BUFF. *Pl. enl.* 628; New Guinea;—*Barita destructor* TEMM., *Cracticus torquatus* GRAY, TEMM. *Pl. col.* 273; New Holland.

Pityriasis LESS. Bill strong, with tip hooked. Orbital region naked. Head covered above with horny shafts, denuded, lamellose.

Sp. *Barita gymnocephala* TEMM., *Cracticus gymnocephalus* GRAY, TEMM. *Pl. col.* 570; Borneo.

Chalybœus CUV., *Phonigama* LESS. (*Phoniachema?*) Bill moderate, moderately curved, emarginate at the tip. Nostrils placed in a fossa, surrounded by membrane, partly covered by plumes. Wings with fourth, fifth and sixth quills subequal, fifth longest of all. Tail long, rounded.

Sp. *Chalybœus paradisœus* CUV., *Paradisœa viridis* GM., BUFF, *Pl. enl.* 634; New Guinea, &c.

Pyrrhocorax CUV., (add *Fregilus* ejusd.), TEMM. Bill moderate or a little longer than head, slender, arched, compressed. Nostrils basal, lateral, covered with setaceous, recumbent plumes. Tarsi covered anteriorly with scutes often obsolete above, with three or four distinct below. Wings with fourth and fifth quills subequal, fourth longest of all.

Fregilus CUV., *Coracia* BRISS., GRAY, (add *Corcorax* LESS., *Cercoronus* CABAN.). Bill long, with tip entire.

Sp. *Pyrrhocorax graculus, Corvus graculus* L., BUFF., *Pl. enl.* 255, NAUM. Taf. 57, fig. 2; violet-black, bill and legs red; the wings reach to the end of the tail, which is straightly truncated. This bird lives on the lofty mountains of Europe, and in winter descends into the plains. In Australia is a species with black bill and black legs, and longer tail, *Pyrrhocorax leucopterus* TEMM. (*Corcorax*) GRAY *Gen. of Birds*, Pl. LXXVIII.

Pyrrhocorax CUV. Bill moderate, with tip emarginate. (Tail broad, subeven, produced beyond the apex of wings.)

Sp. *Pyrrhocorax alpinus* VIEILL., *Corvus pyrrhocorax* L., BUFF. *Pl. enl.* 531, NAUM. l. l. fig. 1, GUÉR. *Icon., Ois.* Pl. 12, fig. 3, on the Alps, the mountains of the south of Europe, &c. CUVIER placed these birds close by *Turdus*, and *Pyrrhocorax*, on the contrary, as a sub-genus with *Upupa*.

Podoces FISCHER. (Is this its place?)

Sp. *Podoces Panderi.* Cons. on this bird C. L. BONAPARTE *Conspectus generum Avium* (L. B. 1850), p. 388.

Family XXXVIII. *Paradiseinæ*. Wings with ten primaries. Wing-coverts short, first quill-feather moderate. Tarsi mostly long, covered anteriorly with transverse, sometimes obsolete scutes. Bill moderate, conical, moderately curved, compressed towards the tip.

Paradisea L. (except *Paradisea tristis*). Bill longer than head, with culmen rounded, the tip slightly deflected, emarginate. Nostrils basal, lateral, concealed by the flocky plumes that cover the base of bill. Tarsus longer than middle fore toe, outer toe longer than inner. Claws large, compressed, curved. Wings with first quill short, fifth and sixth subequal, longest of all. Tail even, broad or rounded. Plumes of hypochondria often longer.

Birds of Paradise. Birds beautifully ornamented, of which all the species belong to New Guinea and the neighbouring islands. They feed on the fruit of fig-trees and also on insects. The Papuas, who sell these birds as an ornament of dress, usually cut off their legs and wings.

Compare LE VAILLANT *Hist. nat. des Oiseaux de Paradis et des Rolliers.* Paris, 1806, 2 vol. fol.—R. P. LESSON, *Hist. nat. des Oiseaux de Paradis et des Epimaques*, Paris, 1835, 1 vol. 8vo.

In the males of most of the species the two middle tail-feathers are lengthened into filaments which exhibit rudiments only of a vane. (*Paradisea* VIEILL., add *Diphyllodes* LESS., *Cicinnurus* VIEILL.)

Sp. *Paradisea apoda* L. (in part), *Paradisea major* SHAW, BUFF. *Pl. enl.* 256, LESS. *Ois. de Par.* Pl. 6, Arou-islands;—*Paradisea minor* FORSTER, LESS., *Paradisea papuana* BECHST., GRAY, LESS. l. l. Pl. 2—5, New Guinea;—*Paradisea rubra* VIEILL., LESS. *Ornith.* Pl. 37, fig. 1, *Ois. de Parad.* Pl. 7, 8;—*Paradisea regia* L., *Cicinnurus spinturnix* LESS., BUFF. *Pl. enl.* 496, CUV. *R. Ani., éd. ill., Ois.* Pl. 39, fig. 3;—*Paradisea magnifica* SCOP., LATH., SONNER. *Voyage à la Nouv. Guin.* Pl. 98, BUFF. *Pl. enl.* 631.

In others those filaments are wanting.

Sp. *Paradisea aurea* GM., *Paradisea sexsetacea* LATH., SONNER. l. l. Pl. 97, BUFF. *Pl. enl.* 633 (*Parotia sexsetacea* VIEILL.);—*Paradisea superba* SCOP., *Parad. nigra* FORST., *Lophorina superba* VIEILL., SONNER. l. l. p. 96, BUFF. *Pl. enl.* 632, LESS. *Ois. de Par.* Pl. 13, 14.

Epimachus CUV. Bill long, slender, cloven as far as under the eyes. Nostrils basal, covered by silken plumes. Wings with fourth quill longest (or in males sixth and seventh subequal, longest of all). Hallux strong, long. (Plumes of hypochondria very long in males.)

† *With bill arched.*

a) *Tail very long, graduated. Cinnamolegus* Lesson.

Sp. *Epimachus speciosus* Gray, *Upupa magna* Gm. (and *U. fusca* ejusd. fem.), Sonner. *Voy.* Pl. 100, 101, Buff. *Pl. enl.* 639, Less. *Ois. de Par.* Pl. 39, 40, New Guinea.

b) *Tail somewhat short, even. Ptiloris* Swains.

Sp. *Epimachus magnificus* Cuv. *R. Ani. Pl.* iv. fig. 2, Less. *Ornith.* Pl. 74, fig. 1, *Cent. Zool.* Pl. 4, 5, Guér. *Icon., Ois.* Pl. 26, fig. 3, New Guinea;—*Epimachus regius* Less., *Ptiloris paradiseus* Swains., Less. *Ois. de Parad.* Pl. 29, 30, Australia.

†† *With bill almost straight, subincurved. Selecucides* Less.

Sp. *Epimachus albus, Paradisea alba* Blumenb., *Abbild. Naturh. Gegenst.* No. 96. Cuv. *R. Ani., éd. ill., Ois.* Pl. 44, fig. 4, New Guinea.

Astrapia Vieill. Bill moderate, slender, subarcuate, emarginate at the tip. Lower mandible shorter. Wings with fifth and sixth quills subequal, longest of all. Tarsi elongate. Tail very long, cuneate, with feathers broad.

Sp. *Astrapia gularis* Vieill., *Paradisea nigra* Gmel., Vieill. *Galer.* Pl. 107; New Guinea.

Oriolus L. (exclus. of many species), Temm., Cuv. Bill moderate, subincurved, with culmen keeled, emarginate towards the tip. Nostrils basal, lateral, surrounded by membrane. Tarsi short, strong. Wings with first quill short, third and fourth subequal, longest of all. Tail subeven, with outer coverts a little shorter.

Sp. *Oriolus galbula* L., Buff, *Pl. enl.* 26, Lesson *Ornith.* Pl. 38, fig. 2, Naumann, Taf. 61; the *golden oriole, le loriot, der Pirol;* the male bright yellow, with black wings and a black spot near the eyes; the female and the young bird greenish. This bird remains here (Holland) only a short time (from May to August). It lays from three to five eggs in a nest artistically built between branches of trees. Cherries are the favourite food of this bird, which, however, lives principally on beetles and caterpillars. In some species (*Oriolus melanocephalus* L., Buff. *Pl. enl.* 79, *Oriolus brachyrhynchus* Swains. &c.) the whole head is black, the plumage, in other respects, very similar. All the species are from the Eastern hemisphere.

Analcipus Swains., *Artamia* Geoffr., *Psaropholus* Selby. Bill scarcely arched. Wings with fourth and fifth quills subequal, longest of all.

Sp. *Oriolus Traylii* Vigors; Himalaya; red-brown with black wings.

Note.—Some other sub-genera are here omitted.

Sphecotheres VIEILL. Bill short, keeled, curved, emarginate. Nostrils placed in a fossa. Orbital region naked. Tarsi short. Hallux large. Wings with first quill short, fourth longest of all. Tail moderate, broad, even.

Sp. *Sphecotheres viridis* VIEILL., *Gal. des Ois.* Pl. 147, Australia;—*Sphecotheres minor* MUELLER, *Verhand.* &c., Timor, &c.

Sericulus SWAINS.

Note.—*Habitus* and characters almost of *Oriolus;* but tarsi longer. Tail even, subemarginate. Wings with third, fourth and fifth quills longest of all, nearly equal. Sp. *Oriolus regens* TEMM., *Pl. col.* 320.

Family XXXIX. *Sturninæ.* Primaries in some nine, in others ten, with the first very small. Wing-coverts short. Tarsi covered anteriorly with transverse scutes, posteriorly and on each side with a continuous, horny scute. Outer toes conjoined at the base only. Bill subulate, mostly straight or moderately curved, in many emarginate before the tip.

Buphaga L. (*Buphagus* BRISS.). Bill short, curved, broad at the base. Lower mandible high, with angle somewhat prominent before the tip. Nostrils basal, placed in a fossa near the culmen of bill. Tarsi longer than middle toe. Claws large, curved, compressed. Wings with first quill very small, second, third and fourth subequal, third longest of all. Tail moderate, cuneate.

Sp. *Buphaga Levaillanti* nob., *Buphaga africana* L., BUFF. *Pl. enl.* 293, LESSON *Ornith.* Pl. 48, fig. 1; Senegal, Cape of Good Hope;—*Buphaga erythrorhyncha* TEMM., *Tanagra erythrorhyncha* STANLEY, SALT *Voyage to Abyssinia, Appendix* IV. p. LIX.; in Nubia, Abyssinia, Madagascar; the *beef-eaters* eat all kinds of insects and especially the larvæ that live under the skin of cattle, on which account they collect together in large flights on pastures.

Gracula L. (in part), TEMM., *Eulabes* CUV. Bill moderate, subcurved, compressed, mostly emarginate before the tip. Nostrils lateral, placed in a plumed fossa. Feet strong; tarsus equalling middle toe. Claws curved, strong. Wings with first quill short, third and fourth subequal, fourth longest of all.

a) *With tail even.*

Sp. *Gracula religiosa* L. (in part), *Eulabes indicus* CUV., BUFF. *Pl. enl.* 268, LESSON *Ornith.* Pl. 37, fig. 2, and some other very similar species from the

Sunda islands and Ceylon, together with one from New Guinea, *Gracula Dumonti* WAGL.; *Mino Dumontii* LESS., with head bald. The other species have naked, yellow, lobes of skin at the back of the head. These birds are blue-black, with yellow legs and bill. They learn to speak very intelligibly.

b) *Tail cuneate. Gymnops* CUV. (Head destitute of plumes, except a narrow plumed streak, extending above the forehead.)

Sp. *Gracula calva* L., BUFF. *Pl. enl.* 200, CUV. *R. Ani., éd. ill., Ois.* Pl. 27, fig. 3; from the Island Luçon.

Pastor TEMM., *Gracula* CUV. Bill moderate, compressed, lengthened and conical, subincurved, emarginate before the tip. Nostrils basal, lateral, oval, partly covered by plumed membrane. Feet strong; tarsus longer than middle toe. Wings with first quill very short, mostly second, more rarely third or fourth, longest of all. Tail even or rounded.

Sp. *Pastor roseus* TEMM., *Turdus roseus* L., BUFF. *Pl. enl.* 251, NAUM. Taf. 63, CUV. *R. Ani., éd. ill., Ois.* Pl. 26, fig. 2; head, wings and tail black, elsewhere rose-red; bill and legs yellow; in Africa and the South of Europe;—*Pastor pagodarum, Turdus pagodarum* GM., LESSON *Ornith.* Pl. 40, fig. 2; India, Bengal; in this and some other species the fourth flag-feather is the longest (*Hœterornis* GRAY, *Sturnia* LESS.).

Note.—Add sub-genus *Acridotheres* VIEILL., GRAY.

Sp. *Pastor tristis, Paradisœa tristis* L., BUFF. *Pl. enl.* 219.

Basilornis TEMM. Bill shorter than head, curved. Head crested, with plumes covering the basal part of bill and the nostrils. Tail rounded. Wings with third, fourth and fifth quills unequal, fourth longest of all.

Sp. *Pastor corythaix* WAGL. (*Basilornis celebensis* TEMM.), H. C. VAN DER BOON MESCH *Nieuwe Verh. van de eerste Klasse van het Koninkl. Instit.* II. bl. 245, with a coloured figure; black with blue-green reflections; a white spot behind the eyes and along the neck, flag-feathers brown-black; bill and legs yellow; at Celebes.

Dilophus VIEILL., GRAY.

Sp. *Dilophus carunculatus, Gracula carunculata* GM., *Sturnus gallinaceus* LATH.

Creadion VIEILL., GRAY, *Philesternus* ISID. GEOFFR. SAINT-HILAIRE[1]. Bill moderate, high at the base, compressed, with tip

[1] *Nouv. Annal. du Mus.* I. 1832, pp. 390—392.

obtuse, rounded. Wings concave, with fourth and fifth quills longest of all. Tail long, rounded (with tail-feathers pointed in males).

Sp. *Creadion carunculatum, Sturnus carunculatus* LATH., *Icterus Novæ Zeelandiæ* QUOY and GAIM., *Voyage de l'Astr.* Pl. 12, fig. 4.

Sturnus L. (in part). Bill moderate, straight, subulate, with culmen flat, with tip obtuse, depressed, rounded, entire. Nostrils basal, partly closed by vaulted membrane. Feet moderate, strong; tarsus longer than middle toe. Tail even, somewhat short. Wings with first quill very short, second longest of all.

Sp. *Sturnus vulgaris* L., BUFF. *Pl. enl.* 75, LESSON *Ornith.* Pl. 65, fig. 1; the *common starling, l'étourneau, der Staar;* a well-known bird, which returns to us in March and migrates in October, remains however in each year in greater or lesser number; in the south of Europe the starling is a permanent bird. Its food differs according to the season of the year, but consists in great part of insects. Older starlings breed mostly twice in the year; they lay from 4 to 7 light sea-green eggs.—*Sturnus cineraceus* TEMM., *Pl. col.* 556, India, Japan, &c.

Amblyrhamphus LEACH. Bill subulate, with culmen rounded, produced between the plumes of forehead, with tip depressed. Nostrils basal, open, small. Wings with nine primaries, third, fourth and fifth subequal, fourth longest of all. Tail somewhat long, broad, rounded.

Sp. *Amblyrhamphus bicolor* LEACH, *Oriolus ruber* GMEL., *Sturnus ruber* CUV., SONNER. *Voyage à la Nouv. Guin.* Pl. 68, GUÉR. *Icon., Ois.* Pl. 20, fig. 3, Buenos Ayres.

Sturnella VIEILL. Tarsi long. Tail moderate, narrow, with feathers pointed.

Sp. *Sturnella collaris* VIEILL., *Sturnus ludovicianus* L. (and *Alauda magna* L.), BUFF. *Pl. enl.* 256, WILSON *Amer. Ornith.* Pl. 19, fig. 2.

Note.—Here are to be inserted some genera of modern writers: *Agelæus* VIEILL., *Chrysomus* SWAINS., *Molothrus* ejusd., *Dolichonyx* ejusd., *Leistes* VIGORS, on which cons. GRAY *Gener. of Birds*, II. pp. 346 and foll.

Cassicus CUV., ILLIG. Bill moderate or longer than head, strong, straight, elongate and conical, acuminate, produced like a semicircular shield above the forehead. Nostrils narrow fissures, naked, lateral, basal. Wings with nine primaries, third and fourth subequal, longest of all. Tail somewhat long, graduated.

Sp. *Cassicus cristatus* Cuv., *Oriolus cristatus* Gmel., Buff. *Pl. enl.* 344, Less. *Ornith.* Pl. 63, fig. 1;—*Cassicus bifasciatus* Spix, *Cassicus montezuma* Less., *Cent. Zool.* Pl. 7;—*Cassicus icteronotus* Vieill., *Oriolus persicus* L., Buff. *Pl. enl.* 184. In all these species the general colour is black, contrasted with bright yellow, especially towards the tail. Black, with the back deep red posteriorly, is *Cassicus hæmorrhous, Oriolus hæmorrhous* L., Buff. *Pl. enl.* 482, Cuv., *R. Ani., éd. ill., Ois.* Pl. 37, fig. 1. Linnæus referred the species known to him to the genus *Oriolus*. They are all from South America.

Icterus Cuv. (*Oriolus* Illig., add *Xanthornus* Cuv.) Bill of various length, acuminate, with culmen produced into a narrow angle above the plumes of forehead. Nostrils basal, oval, covered by membrane. Wings with second, third and fourth quills subequal, third mostly longest of all. Tail rounded or graduated, somewhat long.

a) *With bill straight. Icterus* Cuv. (add *Yphantes* Vieill.)

Sp. *Icterus vulgaris* Daud., *Oriolus Icterus* L., Buff, *Pl. enl.* 532; *le troupiale;* back and belly yellow, head, neck, breast and tail black, with white spots on the wings; in South America, and occasionally in the southern countries of North America.

b) *With bill curved. Xanthornus* Cuv. (and *Pendulinus* Vieill.)

Sp. *Icterus bonana* Daud., *Oriolus bonana* L., Buff, *Pl. enl.* 535, fig. 1, &c.

Chalcophanes Wagl., (*Quiscalus* Vieill.). Bill moderate, curved, acute at the tip, with culmen rounded and produced somewhat amongst the plumes of the forehead. Nostrils basal, placed in a fossa. Wings with nine primaries, second quill or second and third longest of all. Tail long, cuneate, concave.

Sp. *Chalcophanes quiscula, Gracula quiscula* L., *Quiscalus versicolor* Vieill., *Gal.* Pl. 108, Wilson *Amer. Ornith.* Pl. 21, fig. 4 (Buff. *Pl. enl.* 646 var.);—*Chalcophanes major, Quiscalus major* Bonap. *Continuat. of* Wilson Pl. 4, &c. Most of the species of this genus are North American.

Scaphidurus Swains., *Cassidix* Less.

Sp. *Quiscalus ater* Vieill., Gray *Gen. of Birds,* Pl. lxxxiv. &c.

Scolecophagus Swains.

Lamprotornis Temm. Bill mostly moderate (more rarely a little longer than head), with culmen convex, keeled, produced between the plumes of forehead, with tip compressed, emarginate.

Nostrils basal, lateral, placed in a fossa, partly covered by membrane. Wings with ten primaries, the first very small, third or fourth, more rarely fifth, longest of all.

† *African species.*

a) Tail very long, cuneate. Wings with fifth quill longest of all. *Iuida* Less. (in part), Bonap., *Lamprocolius* Sundev. in part.

Sp. *Lamprotornis æneus* Temm., *Turdus æneus* L., Buff. *Pl. enl.* 220, *Lamprotornis longicauda* Swains., *Birds of Western Africa*, I. Tab. 7.

b) Tail rounded. Wings with third and fourth quills sub-equal, longest of all (second, third and fourth in some sinuate internally before the point). *Spreo* Less., *Lamprocolius* Sundev. in part.

Sp. *Lamprotornis bicolor, Turdus bicolor* Gm.

†† *Species from the East Indies and the Indian Archipelago. Lamprotornis* Sundev., *Calornis* Gray. (Tail mostly moderate, rounded. Wings with third quill longest.)

Sp. *Lamprotornis cantor* Temm., *Turdus cantor* Gm., *Calornis panayensis* Gray, Temm. *Pl. col.* 149, Sonner. *Voyage à la Nouv. Guin.* Pl. 73, &c.

Enodes Temm. Bill shorter than head, curved, emarginate. Supra-orbital region beset with small rigid plumes, with shaft naked, lamellose. Tail moderate, cuneate. Wings with third and fourth quills subequal, longest of all.

Sp. *Enodes erythrophrys, Lamprotornis erythrophrys* (previously) Temm. *Pl. color.* 267; Celebes.

Scissirostrum Lafresn.

Sp. *Scissirostrum Pagei* Guér., *Magasin. de Zool.* 1845, *Ois.*, Pl. 59. Hab. in the island Celebes. I have not seen this bird.

Family XL. *Fringillinæ* (*Fringillidæ* Gray, excl. of some genera). Primaries in some nine, in some ten (with first very short). Wing-coverts short. Tarsi covered anteriorly with transverse scutes, posteriorly and on each side with scute continuous. Outer toes conjoined at the base only. Bill short, more seldom moderate, conical, with tip almost always entire (in a few finely emarginate), thick at the base.

Ploceus Cuv. Bill moderate or shorter than head, produced above the forehead, conical, strong, with culmen broad, rounded. Nostrils placed at the base of bill, oval, open or partly covered by recumbent plumes of the forehead. Wings with ten primaries,

the first very short, fourth mostly longest in almost all. Tail short or moderate, subeven or rounded. Tarsus equalling or surpassing in length the middle toe.

Birds of warm countries of the eastern hemisphere, which build an artistic nest of grass, stems and fibres of leaves. LINNÆUS arranged the species known to him under his genus *Loxia*. Sp. *Ploceus philippinus*, *Loxia philippina* L., BUFF. *Pl. enl.* 135, fig. 2; Bengal, Java, the Philippine Islands; the bag-like nest with lateral entrance is suspended on branches of trees; see a figure in BRISSON *Ornith.* III. Pl. 18;—*Ploceus pensilis*, *Loxia pensilis* GM.; SONNERAT *Voy. aux Ind. Or.* Pl. 109, from Madagascar, &c. Comp. DE LAFRESNAYE *Sur la nidification de quelques espèces d'oiseaux de la famille des Tesserins*, GUÉRIN *Revue et Magas. de Zool.* 1850, pp. 315—326, Pl. 5, 6. The species referred to belong to the sub-genus *Euplectes* of SWAINSON, who comprises the species with a longer bill (viz. which almost equals the length of the head) under the genus *Ploceus* proper (*Hyphantornis* GRAY). On other sub-divisions and names consult GRAY *Gen. of Birds*, II. pp. 350 and foll.

Pyrenestes SWAINS.

Sp. *Loxia ostrina* VIEILL., *Pyrenestes sanguineus* SWAINS. *Birds of W. Africa*, I. Pl. 9.

Vidua CUV. Bill short, conical, with culmen produced amongst the plumes of forehead. Nostrils basal, covered by plumes. Wings with ten primaries, the first very small, third, fourth and fifth subequal, longest of all. Tarsus equalling or surpassing middle toe. Tail in males elongate or very long.

a) *With tail-coverts elongate. Vidua* RUEPPELL, CABAN., *Chera* GRAY.

Sp. *Vidua longicauda*, *Chera progne* GRAY, *Emberiza longicauda* GM., BUFF. *Pl. enl.* 635, LESS. *Ornith.* Pl. 59, fig. 1, GUÉRIN *Iconogr., Ois.* Pl. 19, fig. 1.

b) *With middle tail-feathers very long. Coliuspasser* RUEPPELL, *Penthetria* CABAN.

Sp. *Vidua principalis* CUV., *Emberiza serena* L. (and *Emb. vidua* and *Emb. principalis* ejusd.), *Vidua erythrorhyncha* SWAINS., BUFF. *Pl. enl.* 8, fig. 2, SWAINS. *Birds of W. Africa*, I. Pl. 12;—*Vidua paradisæa*, *Emberiza paradisæa* L., BUFF. *Pl. enl.* 194;—*Vidua macroura*, *Loxia macroura* GMEL., BUFF. *Pl. enl.* 183, fig. 1, *Coliuspasser flavoscapulatus* RUEPPELL, &c. All the species are African.

Amadina SWAINSON, *Sporothlastes* CABAN. Bill short, conical, with culmen rounded, curved, produced into an acute angle amongst the feathers of forehead. Nostrils at the posterior margin of bill, covered by plumes of forehead. Wings with ten primaries, the

second, third and fourth quills subequal, longest of all. Tarsus not surpassing the middle toe in length or shorter than it. Hallux long, with claw larger, curved.

We here take the genus *Amadina* in the compass in which SWAINSON has established it (*Natural Hist. and Classificat. of Birds*, II. p. 279), to which he referred *Estrelda, Amadina, Spermestes, Erythura* and *Pytelia* as sub-genera. Here also the number of genera is too much multiplied by modern writers. All the species are from warm countries of the eastern hemisphere, some from Australia, many from Africa. They are small birds mostly elegantly marked; whence many are brought to Europe and kept alive in cages as chamber-birds. To the larger species belongs the *rice-bird, Amadina oryzivora, Loxia oryzivora* L. BUFF. *Pl. enl.* 152, fig. 1, *Dict. univ. d'Hist. nat., Ois.* Pl. 3 A, fig. 2, from the East Indies; from Africa the *Bengali, Amadina Bengala, Fringilla bengalus, Estrelda phœnicotis* SWAINS., BUFF. *Pl. enl.* 115, fig. 1, *Dict. univ.* l. l. fig. 1, SWAINS. *Birds of W. Afr.* I. Pl. 14. More than seventy species of this genus are known.

Loxia BRISSON, ILLIG., TEMM. (add *Corythus* CUV. in part, spec. from gen. *Loxia* L.). Bill shorter than head, strong, keeled, compressed towards the tip, with tip of upper mandible hooked, produced beyond lower. Nostrils basal, lateral, rounded, covered by recumbent plumules at the base of bill. Wings moderate, with nine primaries (the first wanting), first two or second and third subequal, longest of all. Tarsus short, thick, of the length of middle toe. Tail short, forked.

Compare on this genus and some others of this family C. L. BONAPARTE *et* H. SCHLEGEL, *Monographie des Loxiens. Avec* 54 *Pl. col.* Leide et Dusseldorff, 1850, 4to.

Loxia BRISS., ILLIG. TEMM. Tips of mandibles crossing.

Sp. *Loxia curvirostra* L., BUFF. *Pl. enl.* 218, LESS. *Ornith.* Pl. 61, fig. 2, NAUM. Taf. 110, BONAP. *et* SCHLEGEL *Lox.* Pl. 2, 3; the *cross-bill, le bec croisé, der Kreuzschnabel;* the tip of the lower mandible projects above the margin of the upper mandible; the male is red, with black wing- and tail-feathers; the female and the young birds are grey-brown, with yellowish-green tints; this species lives on pine-trees in the north, and visits temperate countries in the winter. In this species the breeding is not confined to any definite time of year, but occurs sometimes even in winter; see HANOW'S *Seltenheiten der Natur u. Oekonom.* I. Leipzig, 1753; s. 277 u. ff.—*Loxia pytiopsittacus* BECHST., NAUM. Taf. 109; rarer and larger than the preceding; the tip of the lower mandible does not project above the margin of upper; it lives in the north of Europe. All the species of this genus, not numerous, are from the Northern hemisphere.

Corythus Cuv. (in part), *Strobilophagus* Vieill. Lower mandible gibbous beneath, with tip concealed under the upper mandible. Wings with second and third quills longest of all.

Sp. *Loxia enucleator* L., Buff. *Pl. enl.* 135, fig. 1 (scarcely worth to quote fig.), Naum. Taf. 112, Bonap. *et* Schl. *Monogr.* Pl. 11, 12 (very good figs.); the *pine bull-finch, le durbec, der Hakengimpel, Fichtengimpel;* in the forests of the high North in Europe and America (*"victitans strobilis; disseminator Pini."* Linnæus).

Psittacopis Nitzsch, Caban., *Psittacirostra* Temm. Bill short, curved; upper mandible produced beyond the much shorter lower, with tip bent downwards. Nostrils placed in the base of bill, partly covered by plumed membrane. Tarsus longer than middle toe. Wings with nine primaries, the second and third subequal, third longest of all. Tail moderate, emarginate.

Sp. *Psittacopis icterocephala, Loxia psittacea* Lath., Temm. *Pl. enl.* 457; from the Sandwich Islands.

Paradoxornis Gould.

Sp. *Paradoxornis flavirostris* Gould;—*Parad. ruficeps;*—*Parad. gularis* Horsf. See Gray *Gen. of Birds*, Pl. xciv. Birds from the East Indies, with bill high, compressed, short.

Pyrrhula Briss., Cuv., Temm. Bill short, broad at the base, thick, with culmen rounded. Nostrils basal, small, covered by bristles. Wings long, with nine primaries, the second and third subequal, longest of all. Tail somewhat long, mostly even, sometimes forked. Tarsi short.

Sp. *Pyrrhula vulgaris* Briss., *Loxia pyrrhula* L., *Pl. enl.* 145, Lesson *Ornith.* Pl. 61, fig. 1, Naum. Taf. 114; the *common bull-finch, le bouvreuil;* Europe, Siberia. In the north of Europe a larger species or variety also occurs, *Pyrrhula major* Brehm, *Pyrrhula coccinea* Selys-Longchamps, which according to Br. is the proper *Loxia pyrrhula* L. In some species the tail is forked. They belong to the sub-genus *Carpodacus.* Sp. *Pyrrhula rosea* Temm., *Fringilla rosea* Pall.;—*Pyrrh. erythrina* Temm., *Loxia erythrina* Pall., both of which species are figured in Naum. Taf. 113.

Fringilla L. (excl. of some species). Bill conical or subulate, with culmen substraight or little curved, mostly short, acuminate, with tips of mandibles subequal, with margins straight. Wings with nine primaries, the first four subequal, second or third longest of all. Tarsus equalling or scarcely surpassing middle toe. Tail even or subforficate.

The *finches*. Social birds, living mostly in woods, some also in rocky places, and some in the neighbourhood of human dwellings. The genus *Fringilla* of LINNÆUS is more natural than his genus *Loxia*, and therefore has undergone fewer modifications. Some indeed of the species of his genus *Loxia* required to be added to it, and others to be referred to *Amadina* (see above, p. 497). Still, however, in the genus *Fringilla* thus limited, many subdivisions have been offered, since the bill especially is subject to many changes in size and form.

a) *With bill short, broad at the base, with culmen obtuse, declivous, substraight. Fringilla* CUV.

Sp. *Fringilla cœlebs* L., BUFF. *Pl. enl.* 54, fig. 1, LESSON *Ornith.*, Pl. 60, fig. 1, NAUM. Taf. 118; the *chaffinch, le pinçon, der Buch-Fink, gemeine Fink;* a very well known bird, breast in the male ruddy, in the female grey; back, above the base of the tail, green, a white and a yellow transverse stripe on the wings;—*Fringilla montifringilla* L., NAUM. Taf. 119, the *mountain-finch;*—*Fringilla chloris, Loxia chloris* L., BUFF. *Pl. enl.* 267, fig. 2, NAUM. Taf. 120; the *green grosbeak.*

Amongst the exotic species to this division may be referred *Fringilla canarina* L., *Crithagra canaria* SWAINS., BUFF. *Pl. enl.* 202, 1, of which the yellow variety, the *canary,* is dispersed everywhere as a chamber-bird.

b) *With bill short, acute, subcompressed. Linaria* BECHST., *Linota* BONAP.

Sp. *Fringilla canabina* L., BUFF. *Pl. enl.* 485, fig. 1, NAUM. Taf. 121; the *common linnet,* &c.

c) *With bill very short, broad at the base, with culmen flat, compressed at the tip, acute. Tail forked. Serinus* of some, *Spinus* KOCH, BREHM, *Chrysomitris* BOIE.

Sp. *Fringilla spinus* L., BUFF. *Pl. enl.* 485, fig. 3, NAUM. Taf. 125; the *siskin,* &c.

d) *With bill moderate, subulate, with tip much compressed. Carduelis* CUV. (*Tail short, subemarginate; wings with first and second quills longest of all.*)

Sp. *Fringilla carduelis* L., BUFF. *Pl. enl.* 4, LESSON *Ornith.* Pl. 60, fig. 2, NAUM. Taf. 124, figs. 1, 2; the *goldfinch, la chardonneret, der Distelfink;* wings black, with a bright yellow spot, throat and head around the bill blood-red, especially in the male; tail black with white margin. The name *carduelis* is borrowed from the food, which it willingly seeks, the seeds of thistles and of many other plants from the natural family of the *compositæ.*

e) *With bill conical, culmen subarcuate, tip emarginate, curved.* (*Tail even.*) *Pyrgita* CUV.

Sp. *Fringilla montana* L., BUFF. *Pl. enl.* 267, fig. 1, LESSON *Ornith.* Pl. 62, fig. 1, NAUM. Taf. 116, figs. 1, 2; the *mountain-linnet, le friquet;*—*Fringilla domestica* L., BUFF. *Pl. enl.* 6, fig. 1, NAUM. Taf. 115; the *house-sparrow, le moineau.*

Coccothraustes Cuv. Bill of the length of head, very broad at the base, conical, with culmen rounded, flat. Head large. Tail short, emarginate. (Tarsus short, strong. First four primaries acuminate, the succeeding truncated, sinuate internally at the point.)

Sp. *Fringilla coccothraustes, Loxia coccothraustes* L., Buff. *Pl. enl.* 145, Lesson *Ornith.* Pl. 61, fig. 1, Naum. Taf. 111; the *common grosbeak, le gros-bec, der Kernbeisser;* remarkable on account of its large bill, pointed like a top.

Pitylus Cuv. Bill shorter than head, high at the base, with culmen curved, tip distinct, curved. Margin of upper mandible waved. Nostrils placed in a fossa at the base of bill. Primaries nine; the third, fourth and fifth subequal, third or fourth longest of all. Tail somewhat long, rounded or even.

Sp. *Pitylus grossus* Cuv., *Loxia grossa* L., Buff. *Pl. enl.* 154; *Pitylus cayenensis, Loxia canadensis* L. (by misprint; read *cayenensis*), Briss. *Ornith.* III. Pl. 11, fig. 3, Buff. *Pl. enl.* 152, fig. 2, &c. All the species of this division are from America. Here belongs also *Loxia cardinalis* L., Buff. *Pl. enl.* 37, which with some other species forms the genus *Cardinalis* Bonap.

Note.—Several genera of modern writers are to be added here. *Saltator* Vieill., *Sporophila* Caban. &c. of which the species were formerly in part assigned to the *Tanagræ*, on which cons. Bonaparte *Conspect. Gen. Avium*, 1850, pp. 488 and foll.

Emberiza L. (exclusive of some species). Bill short, conical, with culmen rounded. Nostrils basal, rounded, partly covered by recumbent frontal plumes. Margins of mandibles sinuate, drawn inwards, descending posteriorly; upper mandible mostly furnished with a tubercle internally. Tarsus equalling or surpassing the middle toe in length. Wings with nine primaries, first three or four subequal, second and third mostly longest of all. Tail somewhat long, even or emarginate.

a) *With posterior claw shorter than hallux. (Wings with first four quills subequal; a compressed tubercle in the middle of palate.)*

Emberiza Brehm (and *Miliaria* ejusd.), *Cynchramus* Boie.

Sp. *Emberiza citrinella* L., Buff. *Pl. enl.* 30, fig. 1, Naum. Taf. 102, figs. 1, 2; Lesson *Ornith.* Pl. 59, fig. 1; the *yellow bunting;* on the upper part of the back the wings and the tail red-brown with black; the two outer tail-feathers at the end of the inside white; head, breast and belly greenish-yellow;—*Emberiza Schœniclus* L., Buff. *Pl. enl.* 247, fig. 2, Naum. Taf.

105, the *reed-bunting;* on the back and wings brown, belly white; the adult male has the head and the throat dark-black.—*Emberiza hortulana* L., BUFF. *Pl. enl.* 247, fig. 1, NAUM. Taf. 103; the *ortolan bunting*, &c.

b) *With posterior claw surpassing hallux in length, somewhat straight. (Wings with first three quills subequal, fourth shorter.)*

Plectrophanes MEYER, BREHM.

Sp. *Emberiza nivalis* L., BUFF. *Pl. enl.* 497, fig. 1, 511, fig. 2, NAUM. Taf. 106, 107; the *snow-bunting;*—*Emberiza calcarata* TEMM., *Fringilla laponica* L., NAUM. Taf. 108, SELBY *Linn. Trans.* 1827, Tab. 1. pp. 156—160, GRABA in OKEN'S *Isis*, 1832, s. 18 (description of the nest and the eggs). These birds make their nests in the north in fissures of rocks; in winter, especially in severe frosts, they visit temperate countries, and feed on seeds of plants and insects. Their plumage is very different at different periods of their life, and, when adult, in their winter- and summer-dress; hence the first species appears under two different names in GMELIN.

Note.—Here are to be placed some genera of modern writers: *Fringillaria* SWAINS., *Gubernatrix* LESS. (*Lophocorythus* GRAY), &c.

Cissopis VIEILL., *Bethylus* CUV. Bill short, thick, with culmen convex, tip hooked, inflected, compressed, emarginate; lower mandible rounded, inflated, with tip ascending. Nostrils basal, lateral, oval. Wings short, with third, fourth and fifth quills subequal, third longest of all. Tail graduated, elongate. (Is this its place?)

Sp. *Cissopis bicolor* VIEILL., *Lanius piscatorius* LATH., VIEILL. *Gal. des Ois.* Pl. 140; LESS. *Ornith.* Pl. 46, fig. 2; South America. CUVIER placed this bird as a sub-genus with *Lanius;* according to GRAY and others it ought to be arranged in the neighbourhood of *Tanagra.*

Procnias HOFFMANSEGG, ILLIG., TEMM., *Tersa* VIEILL., GRAY. Bill short, keeled, depressed at the base, broad, compressed at the tip, subhooked, emarginate, with gape ample. Nostrils basal, placed at the culmen of bill, marginate. Tarsus equalling middle toe. Wings with first three quills subequal, second and third longest of all. Tail subemarginate, short.

Sp. *Procnias ventralis* ILLIG., *Ampelis tersa* L., TEMM. *Pl. col.* Pl. 5, GUÉR. *Iconogr., Ois.* Pl. 8, fig. 6 (fig. of the bill); Brasil.

Tanagra L.[1], *Thraupis* BOIE. Bill short, subtrigonal at the base, with culmen declivous towards the tip; upper mandible

[1] *Tangara* is a Brasilian name for some species of this genus.

emarginate behind the tip, produced beyond lower. Nostrils basal, rounded, partly covered by plumes of forehead. Tarsi of the length of middle toe or longer than it. Wings with nine primaries, first four subequal, second and third mostly longest of all. Tail even.

A numerous genus of mostly small American birds, often with shining coloured plumage, in great part from the southern hemisphere. From the form of the bill and other characters different sub-genera have been distinguished.

Rhamphopis VIEILL. Lower mandible dilated at the base, with horny covering produced beyond the upper.

Sp. *Tanagra jacapa* L., BRISS. *Ornith.* II. Tab. 38, fig. 3; BUFF. *Pl. enl.* 128, LESS. *Ornith.* Pl. 54, fig. 2; Cayenne, Caraccas; dark red-brown, the breast in the male red; bill red.

Tanagra GRAY. Bill compressed towards the tip, emarginate. Wings with second and third quills longest of all. (Add *Calliste* BOIE, GRAY.)

Sp. *Tanagra episcopus* L., BRISS. *Ornith.* III. Tab. 3, fig. 2, BUFF. *Pl. enl.* 178, fig. 1;—*Tanagra tatao* L., BRISS. *Ornith.* III. Tab. 1, fig. 1, BUFF. *Pl. enl.* 7, fig. 1, 127, fig. 2, *Dict. univ. d'Hist. nat., Ois.* Pl. II. c, fig. 1, &c. See fig. in SCLATER'S beautiful publication, Pl. 1. *A Monograph of the Birds forming the Tanagrine genus Calliste*, illustrated by coloured plates. By PHILIP LUTLEY SCLATER, London, 8vo, Part 1.

Euphone DESMAR. Bill with culmen keeled, curved, with margin of upper mandible often dentate. Wings with second quill longest. Tail short, subemarginate.

Sp. *Tanagra chlorotica* L., BRISS. *Ornith.* III. Tab. 2, fig. 3, BUFF. *Pl. enl.* 114, fig. 1, &c.

Tachyphonus VIEILL. Bill strong, shorter than head, or moderate, with margins sinuate. Lateral nostrils placed in a fossa.

Sp. *Tanagra cristata* L., BUFF. *Pl. enl.* 301, fig. 1; *Tachyphonus sanguinolentus* LESS. *Cent. Zool.* Pl. 39, &c.[1] (For some other sub-genera, omitted here, proposed by VIEILLOT and SWAINSON, see GRAY *Gener. of Birds*, II.)

Family XLI. *Alaudinæ*. Primaries ten or nine. Secondaries elongate. Wing-coverts short. Tarsi covered anteriorly and posteriorly with transverse scutes, longer than middle toe. Outer toes conjoined at the base only. Bill conical, mostly short, with tip entire.

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[1] Various other species of *Tanagra* are figured and described in this work.

A small family, on which the former closes by some species of *Emberiza*, but which differs from them in a remarkable manner in the covering of the tarsi.

Alauda L. (in part)[1]. Bill shorter than head, conical or subulate. Nostrils basal, lateral. Wings with first quill spurious or none, third and fourth quills subequal, longest of all. Tail even or emarginate. Toes short. Posterior claw longer than hallux, acute, somewhat straight.

The *larks*. These birds make their nests upon the ground; the female lays 4 or 5 grey or reddish eggs, commonly with brown spots. They live mostly in society, and sing whilst on wing, mounting perpendicularly upwards. They feed on insects and seeds, and, with the exception of a few species of North America (of the sub-genus *Phileremos*), all belong to the Eastern hemisphere.

a) *With bill thick.* (Tarsi somewhat short. Tail short.)

Melanocorypha Boie.

Sp. *Alauda calandra* L., Buff. *Pl. enl.* 363, fig. 2; Southern Europe and North Africa;—*Alauda tatarica* Pall.—*Alauda clot-bey* Temm. *Mus. L. B., Ierapterhina Cavaignacii* Lafresnaye *Magas. et Revue de Zool.* 1851, Pl. 1; North Africa.

Phileremos Brehm, *Otocoris* Bonap.

Sp. *Alauda alpestris* L., Buff. *Pl. enl.* 650, fig. 1, *Dict. univ. d'Hist. nat., Ois.* Pl. 29, fig. 2.

b) *With bill slender.*

Alauda auct.

Sp. *Alauda arvensis* L., Buff. *Pl. enl.* 363, fig. 1, Naumann, Taf. 100, fig. 1; the *sky-lark, l'alouette, die Feldlerche;—Alauda cristata* L., Buff. *Pl. enl.* 503, fig. 1, Lesson *Ornith.* Pl. 66, fig. 2; Naum. Taf. 99, fig. 1, Cuv. *R. Ani., éd. ill., Ois.* Pl. 32, fig. 1, &c.

Alœmon Blas. and Keyserl., (*Certhilauda* Swains.). Bill long, slender, curved. Wings with first quill short, third, fourth and fifth subequal, longest of all. (Claw of hallux elongate, but less than in *Alauda*. Tarsi elongate.)

Sp. *Alœmon desertorum, Alauda desertorum* Stanley, *Alauda bifasciata* Lichtenst., Temm. *Pl. col.* 393; Arabia, North Africa, and sometimes

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[1] Some species of the genus *Alauda* of Linnæus belong to *Anthus* Bechst.; *Alauda magna* L. is *Sturnus ludovicianus*. See above p. 493.

in Spain;—*Alauda africana* GM., BUFF. *Pl. enl.* 712, Cape of Good Hope, &c.

Macronyx SWAINS. Bill moderate, slender, subcurved, keeled, obscurely emarginate at the tip. Nostrils basal, lateral, placed in fossa, elongate. Tarsi long, exceeding the middle toe. Toes elongate; hallux long, furnished with a long, acute claw.

Sp. *Macronyx flavicollis* SWAINS., *Alauda capensis* L., BUFF. *Pl. enl.* 504, fig. 2, RUEPPELL *neue Wirbelth.* Pl. 38, fig. 2; Africa.—(The covering of the tarsi appears to justify the position of this genus near *Alauda* rather than near *Anthus*.)

Family XLII. *Parinæ*. Primaries ten, with first short. Wing-coverts short. Tarsi covered anteriorly with long scutes, or above with a continuous scute, below with transverse scutes, posteriorly within and without with a continuous scute. Toes shorter than tarsus, the outer concrete at the base only. Claws curved, compressed, acute. Bill short, conical.

Parus L. Bill very entire, covered at the base by setæ, short, sometimes very short. Nostrils basal, lateral, concealed by recumbent plumules of forehead. Wings with third and fourth or fourth and fifth quills longest of all. Tail moderate or elongate. (Tongue truncated, terminated by setæ.)

The *titmice*. Small birds of the Eastern hemisphere, some also from North America. Their food consists of insects and seeds. Most of the European species breed twice a year, and lay many eggs; on the second occasion, however, fewer than on the first. The young ones are fed chiefly with caterpillars.

a) *With first quill short.*

Sp. *Parus major* L., BUFF. *Pl. enl.* 3, fig. 6, NAUM. Taf. 94, fig. 1, CUV. *R. Ani., éd. ill., Ois.* Pl. 32, fig. 4; the *great titmouse, la charbonnière, la grosse mésange, die Kohl-meise;* back olive-coloured, wings and tail greyish, outer tail-feather white and a large spot under the eye white also, belly yellow-green, head, throat and middle of the breast, steel-coloured black;—*Parus cæruleus* L., BUFF. *Pl. enl.* 3, fig. 2, LESS. *Ornith.* Pl. 66, fig. 1; the *blue titmouse*, &c. In these species the tail is even and shorter than the body. The following is distinguished by a tail longer than the body, the tail-feathers from without inwards lengthening gradually, *Parus caudatus* L., the *long-tailed titmouse*, BUFF. *Pl. enl.* 502, fig. 3, NAUM. Taf. 95, figs. 4, 5, 6; in this species the bill is very short with culmen strongly curved (the sub-genus *Mecistura* LEACH).

From this the genus *Psaltria* TEMM. is not sufficiently distinguished.

Sp. *Parus exilis* GRAY, *Psaltriacxilis* TEMM. *Pl. color.* 603, fig. 4; a species from Java, which is not larger than the common species of humming-birds.

b) *With first quill spurious, very short.*

Calamophilus LEACH. Tail long, graduated. Sp. *Parus biarmicus* L., BUFF. *Pl. enl.* 618, figs. 1, 2, GUÉR. *Icon., Ois.* Pl. 18, fig. 2; the *bearded titmouse;* makes its nest in reeds, fixed to the stem of coarse grasses.

Ægithalus VIGORS, *Paroides* KOCH. Tail short, emarginate. Sp. *Parus pendulinus* L., NAUM. Taf. 97; a very small species from the East and North of Europe, whose nest interwoven very artistically of fibres of bark, and the cotton of the seeds of willows, and fastened to a reed or a thin willow-branch and surrounded by closely tangled bushes or bulrushes, is protected from the wind and withdrawn from sight.

Sphenostoma GOULD. Bill short, compressed, curved. Nostrils basal, placed in a fossa. Wings with first quill short, fourth and fifth longest of all. Tail long, graduated.

Sp. *Sphenostoma cristatum* GOULD, *Birds of Australia.*

Regulus CUV. Bill short, slender, subulate, subemarginate before the tip. Nostrils covered by a rigid, decumbent plumule. Wings with first quill short, fourth and fifth longest of all. Tail moderate, even or subemarginate, with feathers pointed. Tarsi long, covered anteriorly and above with a continuous scute.

Sp. *Regulus flavicapillus* NAUM., *Motacilla regulus* L., LESS. *Ornith.* Pl. 70, fig. 2, NAUM., Taf. 93, figs. 1, 2, 3; the *gold-crested wren;—Regulus ignicapillus* BREHM, *Regulus pyrrhocephalus* ejusd., BUFF. *Pl. enl.* 651, fig. 3, NAUM. Taf. 93, figs. 4, 5, 6, GUÉRIN *Icon., Ois.* Pl. 14, fig. 3. These species are the smallest European birds. They live in society, breed twice a year, and in their mode of life much resemble the titmice.

Family XLIII. *Certhianæ.* Primaries ten, with first short. Wing-coverts short. Tarsi long, covered anteriorly with transverse scutes, at the sides with a continuous scute. Outer toes conjoined at the base only. Claws compressed, curved; posterior larger than anterior middle. Bill moderate or longer than head, slender, mostly subincurved, more rarely straight.

Sitta L. Bill moderate, straight, subulate, somewhat round, compressed at the tip. Nostrils basal, rounded, covered by bristles. Wings moderate, with first quill short, fourth and fifth mostly longest of all. Tail short, even. Hallux long.

Sp. *Sitta europæa* L., *Sitta cæsia* MEYER and WOLF, BUFF. *Pl. enl.* 623, fig. 1, NAUM. Taf. 139, LESS. *Ornith.* Pl. 65, fig. 2; the *nuthatch, la*

sitelle, le torchepot, der Kleiber, der Blauspecht; back, tail and wings bluish-grey, rosy-yellow below, a black streak across the eye. A restless little bird, which climbs upon the branches of trees not only upward but downwards also, with its head below, which the woodpeckers canno do. It lives on insects, seeds and nuts.

Note.—Add genus *Dendrophila* SWAINS.

Sittella SWAINS. Wings long, with second, third and fourth quills subequal, longest of all, fifth a little shorter than these.

Sp. *Sitta pilcata* GOULD, *Proceed. Zool. Soc.* 1837, p. 151, *Sitta melanocephala* ejusd. *Birds of Austr.* &c.

Certhia ILLIG. (species from gen. *Certhia* L.). Bill moderate, slender, subincurved. Nostrils basal, partly covered above by a vaulted membrane. Wings with first quill short, second and third gradually longer, fourth and fifth longest of all. Tail graduated, with feathers pointed. Toes long; claws curved, the posterior longest of all.

Sp. *Certhia familiaris* L., BUFF. *Pl. enl.* 681, fig. 1, NAUM. Taf. 140, LESS. *Ornith.* Pl. 72, fig. 1; the *common creeper, le grimpereau, der Baumläufer;* breast and belly white, a white streak above and behind the eyes, tail red-brown, wings brown, spotted yellowish white and red; a small, lively bird, that seeks for small insects, especially beetles and spiders, on the branches of trees, and does not leave us even in winter.

Salpornis GRAY. (Tail even, short, with feathers rounded. Other characters almost of *Certhia.*)

Sp. *Certhia spilonota* FRANKLIN, *Proceed. Zool. Soc.* 1830, 1831, p. 121, GRAY *Gen. of Birds,* Pl. XLIV. fig. 1, India.

Caulodromus GRAY.

Climacteris TEMM.

Sp. *Climacteris picumnus* TEMM., *Certhia leucophæa* LATH., TEMM. *Pl. col.* 281, fig. 1;—*Climacteris scandens* TEMM. l.l. fig. 2, &c. (Species from Australia.)

Tichodroma ILLIG. Bill long, subcurved, slender, trigonal at the base. Nostrils basal, partly covered by vaulted membrane. Toes slender, long, with claws curved, the posterior longest. Wings ample, with first quill short, fourth and fifth longest of all. Tail rounded.

Sp. *Tichodroma muraria, Certhia muraria* L., BUFF. *Pl. enl.* 372, NAUM. Taf. 141, LESS. *Ornith.* Pl. 77, fig. 2, CUV. *R. Ani., éd. ill., Ois.* Pl. 41, fig. 1; *der Mauerläufer;* grey with a crimson spot on the wings; this

bird lives on the highest mountains of central Europe, and feeds on insects, especially on larvæ and spiders. It is a bird of passage which in the winter descends into lower districts, and then even visits towns situated in the neighbourhood of high mountains, living in old buildings and towers.

Family XLIV. *Nectariniæ*. Primaries in some nine, in some ten, the first short. Wing-coverts short. Tarsi longer than middle toe, covered anteriorly with transverse scutes, at the sides with a continuous scute. Outer toes conjoined at the base only. Claw of hallux curved, scarcely or not longer than anterior middle. Tongue long, mostly terminated by setæ or bifid.

Nectarinia ILLIG. (in part), TEMM., GRAY, *Cinnyris* CUV. Bill moderate or long, subcurved or arched, with margins serrate and toothed (the incisures not distinguishable by the naked eye). Nostrils placed in a fossa, lateral, basal. Wings with ten primaries, the first short, the fourth (more rarely the third) longest of all. Tarsi equalling or surpassing the middle toe in length.

Arachnothera KUHL, TEMM. Bill long, trigonal at the base, subcurved. Wings with quills from the third to the fifth subequal, fourth or third longest of all. Tail broad, even, short.

Sp. *Nectarinia longirostris, Certhia longirostris* LATH., TEMM. *Pl. col.* 84, fig. 1;—*Nectarinia inornata, Cinnyris affinis* HORSF. TEMM. *Pl. col.* 84, fig. 2, &c.; species from the East Indies, especially from the island Sumatra. Compare S. MUELLER *Verh. over de nat. Gesch. der Nederl. Overzeesche Bezittingen, Aves*, pp. 67—70. They are larger than the species of the following sub-genus and very uniformly coloured, above brownish-green, below grey or yellow.

Nectarinia TEMM. Bill moderate or a little longer than head, slender. Tail moderate, even, more rarely graduated (and in males with two middle feathers elongate). Tarsi longer than middle toe, slender. (Males adorned with splendid metallic plumage and shining colours.)

Sp. *Nectarinia senegalensis, Certhia senegalensis* L., BRISS. *Ornith.* III. Pl. 34, fig. 2, CUV. *R. Ani., éd. ill., Ois. Pl.* 42, fig. 4, LESS. *Ornith.* Pl. 76, fig. 2.—*Nectarinia chalybœa* L., BUFF. *Pl. enl.* 246, fig. 3, &c. To those species in which the two middle tail-feathers are very long, belongs *Nectarinia pulchella, Certhia pulchella* L., BUFF. *Pl. enl.* 670, fig. 1, SWAINS. *Birds of W. Africa*, II. Tab. 14, &c. All the species of this numerous genus are from the warm countries of the eastern hemisphere, and rival the *Humming-birds* of America in brilliancy of colours.

Drepanis Temm. (*Melithreptus* Vieill. in part). Bill moderate or long, arched, compressed, with margins entire; upper mandible longer than lower. Wings with nine primaries, the second and third longest of all. Tail short, even or subemarginate. Tarsi long.

Sp. *Drepanis pacifica, Certhia pacifica* Gm., *Vestiaria hoho* Less.;—*Drepanis coccinea, Certhia coccinea* Forster, Blumenb. *Abb. naturh. Gegenst.* No. 16, Less. *Ornith.* Pl. 76, fig. 1, Guér. *Icon., Ois.* Pl. 24, fig. 2; male scarlet-red, with wing- and tail-feathers black; a small bird, found at the Sandwich Islands, with the feathers of which the inhabitants were used formerly to adorn the head-dress and mantles of their chiefs. In another species, also from the Sandwich Islands, the lower mandible attains only half the length of the upper, *Hemignathus* Lichtenstein, *Abhandl. der Akad. zu Berlin, Physik. Kl.*, 1838, pp. 34, 35; Sp. *Drepanis lucida* Gray, *Hemignathus lucidus* Lichtenst., l. l., Tab. v. figs. 2, 3, *Heterorhynchus olivaceus* Lafresn., *Magas de Zool.* 1839, *Ois.* Pl. 10.

Dicæum Cuv., Temm. Bill moderate or short, acuminate, with culmen curved, margins very entire. Wings with nine primaries, the first three subequal, second longest of all. Tail short, even. (Outer toes rather more concrete than in the other genera of this family.)

Sp. *Dicæum cruentatum, Certhia cruentata* L., Sonn. *Voyage aux Ind. Or.* Pl. 117, fig. 1, Guér. *Iconogr. Ois.* Pl. 24, fig. 1;—*Dicæum sanguinolentum* Temm. *Pl. color.* 478, fig. 2;—*Dicæum hirundinaceum, Dicæum pardalodus* Cuv., Lafresn., Guér. *Mag. de Zool.* 1833, *Ois.* Pl. 14. (This last species forms the genus *Myzanthe* Hodgs.)

Cæreba Vieill. (*Nectarinia* Cuv., *Arbelorhina* Caban.) Bill moderate or a little longer than head, arched or moderately curved, slender, emarginate at the tip, with culmen keeled. Wings with nine primaries, the first three subequal, the second longest of all. Tail short, even.

Sp. *Cæreba cyanea, Certhia cyanea* L., Buff. *Pl. enl.* 83, fig. 2, Lesson *Ornith.* Pl. 77, fig. 1; Cayenne, Guyana, &c.

Dacnis Cuv. Bill moderate or short, conical, acuminate, with culmen keeled. Wings with nine primaries, third and fourth longest of all. Tail moderate or somewhat short, subemarginate.

Sp. *Dacnis cayana, Motacilla cayana* L., Briss. *Ornith.* iii. Pl. 28, figs. 1, 4, Buff. *Pl. enl.* 669, fig. 1, from which Strickland (Jardine *Contrib. to Ornith.* 1851) distinguishes *Dacnis melanotis* as a species, Buff. *Pl. enl.* 669, fig. 2, Less. *Ornith.* Pl. 64, fig. 2; which, according to Sclater, appears to be the same as *Dacnis angelica* De Filippi;—*Dacnis atricapilla*

GRAY, *Certhia spiza* L.?, *Certhia spiza* GM. var. β., BUFF. *Pl. enl.* 578, fig. 2, &c. Compare SCLATER in JARDINE, *Contrib. to Ornith.* 1851, Part IV. These little birds of South America appear, like the *Certhiæ*, to creep on trees.

Conirostrum ORBIGNY, LAFRESN.

See *Synops. Avium Americæ, Revue Zool.* 1842.

Diglossa WAGL., *Campylops* LICHT., *Uncirostrum* LAFRESN. Bill moderate, compressed, straight, with tip hooked; lower mandible gibbous, ascending. Wings with fourth quill longest. Tail rounded.

Comp. WAGLER, *Isis*, 1832. Sp. *Diglossa baritula* WAGL., GRAY, *Gen. of Birds*, Pl. XLII.;—*Diglossa bruneiventris* DESMURS, *Pl. peint.* 43, &c.

Zosterops VIGORS, HORSF. Bill shorter than head, acuminate, with culmen subcurved, finely emarginate at the tip. Nostrils placed in a lateral fossa, covered by membrane, linear. Wings with ten primaries, third and fourth subequal, longest of all. Tarsi long. Tail moderate, even.

Sp. *Zosterops madegascariensis, Motacilla madegascariensis* L., BRISS. *Ornith.* III. Pl. 28, fig. 2;—*Zosterops flava*, SWAINS. *Birds of W. Africa*, II. Pl. 3;—*Zosterops palpebrosa, Sylvia palpebrosa*, TEMM. *Pl. col.* 293, fig. 3. Small birds mostly of a yellow-green colour, greyish beneath; they occur in the East Indies, Africa and Australia.

Melithreptus VIEILL. (in part), GRAY. Bill shorter than head, subulate, with culmen rounded. Nostrils placed in a fossa. Wings with ten primaries, third, fourth and fifth longest of all, subequal. Tail moderate, even.

Sp. *Melithreptus lunulatus, Certhia lunulata* SHAW, *Meliphaga atricapilla* TEMM. *Pl. col.* 335, fig. 1, &c. Species from Australia and Van Diemen's Land.

Myzomela VIGORS and HORSF. Bill moderate or longer than head, slender, curved, compressed towards the tip, acuminate. Nostrils basal, covered by membrane, with aperture linear. Wings with ten primaries, third, fourth and fifth subequal, third and fourth mostly longest of all. Tail subemarginate or even, moderate.

Sp. *Myzomela sanguinolenta, Certhia sanguinolenta* LATH.;—*M. chermezina* GRAY, *Gen. of Birds*, Pl. XXXVIII.;—*Myzomela Boici* MUELLER, *Verh. over de nat. Gesch. &c. Aves*, Tab. 10, figs. 1, 2, &c.

From this genus *Acanthorhynchus* GOULD, *Proceed. Zool. Soc.* 1827, p. 24, does not appear to be sufficiently distinct. Sp. *Acanthorh. tenuirostris, Certhia cucullata* SHAW, &c. The species of this genus are small, and live mostly in New Holland, some on the islands of the Indian Archipelago.

Promerops BRISS., *Philoturus* SWAINS. Bill long, subcurved; nostrils linear, placed in a fossa. Tongue feathery. Wings with ten primaries, the first short, the fourth longest of all. Tail long, cuneate.

Sp. *Promerops cafer, Merops cafer* L. (and *Upupa promerops* ejusd.), BUFF. *Pl. enl.* 637, GUÉR. *Iconogr., Ois.* Pl. 26, fig. 2; South Africa.

Meliphaga LEWIN, TEMM., *Philedon* CUV. Bill moderate or longer than head, keeled, with culmen curved, compressed at the tip, emarginate. Nostrils lateral, covered by membrane, placed in a fossa (sometimes pervious). Wings with ten primaries, the first short, fourth and fifth subequal, longest of all. Tail moderate or long. Tarsi long.

Acrulocercus CABAN., *Moho* LESS. Bill moderate. Tail long, graduated, with middle feathers curved.

Sp. *Meliphaga fasciculata, Merops niger* GM., *Merops fasciculatus* LATH., DIXON *Voy. round the World*, London, 1789, 4to, p. 357 and Pl., MERR. *Avium rar. Icon.* Tab. II.; TEMM. *Pl. col.* 471; black, with a bunch of long yellow feathers at the sides; from the Sandwich Islands.

Anthochæra VIGORS, HORSF. Bill moderate. Tail elongate, graduated. In many a pendulous caruncle on each side of the throat, destitute of feathers.

Sp. *Meliphaga carunculata, Merops carunculatus* LATH., *Anthochæra Lewini* VIGORS and HORSF., PHILIP *Voy. to Bot. Bay*, 1789, Pl. 28, p. 164;—*Meliphaga inauris, Anthochæra inauris* GRAY, *Creadion carunculatus* VIEILL. *Gal.* Pl. 94.

Acanthogenys GOULD. Tail moderate, broad, even. A naked place below the eyes, with cheeks spinose.

Sp. *Meliphaga rufogularis, Acanthogenys rufogularis, Proceed. of the Zool. Soc.* 1837, p. 153.

Tropidorhynchus VIGORS and HORSF., *Philedon* SWAINS. Bill strong, with culmen acute. Nostrils nearly in the middle of bill. Tail long, even, with point broad. Head with scattered hairs.

Sp. *Meliphaga corniculata, Merops corniculatus* LATH., WHITE *Voy. to New South Wales*, p. 190, Pl. 16.

Prosthemadera GRAY. Bill moderate, curved, broad at the base. Tail long, even.

Sp. *Meliphaga circinnata, Merops circinnatus* LATH., *Merops novæ Hollandiæ* GMEL., *Philemon cincinnatus* VIEILL. *Gal.* Pl. 183, CUV. *R. Ani., éd. ill., Ois.* Pl. 26, fig. 1. Black, with green and violet reflections; with white, loose plumules on each side of the neck, elegantly rolled in spirals. New Zealand.

Note.—On some other sub-genera, omitted here, cons. GRAY, *Genera of Birds*, I.

Phyllornis BOIE. Bill moderate, in some a little longer than head, with culmen keeled, subcurved, with tip curved, emarginate. Nostrils basal, placed in a fossa. Wings with ten primaries, fourth and fifth subequal, fourth longest of all. Tail moderate, even. Feet short; tarsi somewhat thick, shorter than middle toe, covered above anteriorly with a continuous scute.

To the genus *Phyllornis* belong light-green bright-coloured birds of the East Indies and the Sunda Islands; GMELIN and LATHAM referred the species known to them to the genus *Turdus*. Sp. *Phyllornis aurifrons* TEMM. *Pl. col.* 484, fig. 1;—*Phyllornis cochinchinensis, Turdus cochinchinensis* GM., BUFF. *Pl. enl.* 643, fig. 3, TEMM. *Pl. col.* 484, fig. 2;—*Ph. cyanopogon* TEMM. *Pl. col.* 512, fig. 1, &c.

Hypsipetes VIGORS. (Is this its place?) Bill moderate, keeled, emarginate. Wings with fourth and fifth quills subequal, longest of all. Tail long, with point broad, emarginate. Tarsi short.

Sp. *Hypsipetes psaroides* VIGORS; Himalaya.

Note.—Here also, according to CABANIS, should be referred genera *Sibia* HODGSON and *Yuhina* HODGS. (sub-genera *Myzornis, Polyodon* and *Ixulus*); GRAY has placed *Yuhina* amongst the *Luscinidæ*.

Family XLV. *Liotrichinæ* (*Liotrichidæ* CABAN.). Primaries ten. Wing-coverts short. Tarsi covered anteriorly with transverse scutes, posteriorly and on each side with a continuous scute. Bill compressed, mostly short, almost always emarginate.

Cissa BOIE, GRAY. (Species of *Kitta* TEMM.). Bill shorter than head, strong, emarginate, with culmen curved. Nostrils basal, covered by plumes of forehead. Bristles at the angle of mouth. Wings with fourth, fifth and sixth quills subequal, the fifth longest of all. Tail somewhat long, graduated. (Feathers of back decomposed, long.)

Sp. *Cissa sinensis, Coracias sinensis* GM., *Corvus speciosus* SHAW, BUFF. *Pl. enl.* 620;—*Cissa thalassina* TEMM., *Pl. enl.* p. 401.

Garrulax LESS. Bill shorter than head, acuminate, keeled. Nostrils placed in a fossa at the base of bill. Wings with fifth and sixth quills longest of all. Tail somewhat long, rounded. Tarsi long. Posterior claw longer than the rest.

Sp. *Garrulax perspicillatus, Turdus perspicillatus* GM., BUFF., *Pl. enl.* 604;—*Garrulax mitratus* GRAY, *Timalia mitrata* SAL., MUELLER, *Tijdschr. voor nat. Gesch. en Physiol.* II. 1835, Pl. IX. fig. 3;—*Garrulax lugubris* GRAY, *Timalia lugubris* S. MUELLER, l. l. fig. 2; the last two species are both from Sumatra, &c.

Trochaloptera HODGS.

Pterocyclus GRAY. Bill short, subulate. Bristles at the cheeks long. Wings with fifth, sixth and seventh feathers longest of all. Tail long, rounded.

Sp. *Garrulax lineatus* BLYTH, *Pterocyclus setifer* GRAY;—*Garrulax erythrocephalus* BLYTH, &c.; species from the central parts of Asia.

Actinodura GOULD, *Leiocincla* BLYTH, *Ixops* HODGS.

Cinclosoma VIGORS, HORSF. Bill short, with culmen nearly straight, subulate. Wings short, with fourth and fifth quills longest of all. Tail elongate, graduated.

Sp. *Cinclosoma punctatum, Turdus punctatus* LATH. &c. Species from Australia and Van Diemen's Land.

Pomatorhinus HORSF. Bill moderate, curved, keeled, compressed, with margins entire. Nostrils basal, lateral, covered by a scale. Gape of mouth produced under the eyes. Tarsi long. Wings concave, with quills gradually longer up to the fourth, the fourth, fifth and sixth subequal, longest of all. Tail long, graduated.

Sp. *Pomatorhinus montanus* HORSF.; Java, Sumatra;—*Pomatorhinus temporalis* VIG. and HORSF., *Pomatorhinus trivirgatus* TEMM. *Pl. col.* 443; Australia, &c.

Timalia HORSF. Bill shorter than head, broad at the base, curved, compressed, finely emarginate at the tip. Nostrils basal, placed in a fossa, covered by a scale. Short bristles at the angle of bill. Tarsi long. Wings short, concave, with fifth and sixth quills subequal, longest of all. Tail moderate, rounded or graduated. (Feathers of back, and often also of throat, decomposed.)

Sp. *Timalia thoracica* TEMM. *Pl. col.* 76; Java, Sumatra;—*Timalia nigricollis* TEMM. *Pl. col.* 594, fig. 2, &c.

Sub-genera *Myzornis* HODGS. Sp. *Timalia gularis* HORSF., *Myiothera gularis* TEMM. *Pl. color.* 442, fig. 1, &c.

Sub-gen. *Chrysomma* HODGS. Sp. *Timalia hypoleuca* FRANKL., DE LAFRESN., GUÉR. *Mag. de Zool.* 1835, *Ois.* Pl. 39, &c.

Macronus JARD.

Sp. *Timalia trichorrhos* TEMM. *Pl. col.* 594, fig. 1.

Jora HORSF. Bill moderate or shorter than head, compressed, emarginate. Wings with first quill short, fourth, fifth and sixth subequal, longest of all. Secondaries long. Tail even.

Sp. *Jora tiphia, Motacilla tiphia* L., EDWARDS *Birds*, Tab. 79;—*Jora Lafresnayi* HARTL. *Magas. de Zool.* 1845, *Ois.* Pl. 60, &c. Species from the East Indies, Ceylon and the Sunda Islands; comp. HARTLAUB, l. cit.

Liothrix SWAINS.[1], *Furcuria* LESS. Bill shorter than head, strong, compressed, emarginate, with culmen curved. Nostrils basal, lateral. Bristles at the angles of mouth. Wings somewhat short, rounded, with fifth and sixth quills subequal, longest of all. Tarsi slender, long. Tail moderate or somewhat long.

Sp. *Liothrix sinensis, Tanagra sinensis* GM., *Parus furcatus* TEMM. *Pl. color.* 237, fig. 1; China, Himalaya. This species, with forked tail, formed originally the genus of SWAINSON, which LESSON, simultaneously with him, distinguished (as a sub-genus of *Parus*); *Traité d'Ornith.* p. 457. Other species from central Asia, which may be added to it, have an even tail, some a wedge-shaped tail, as *Liothryx chrysocephala, Muscicapa variegata* DELESSERT, GUÉR. *Magas. de Zool.* 1840, *Ois.* Pl. 19.

Mimus BOIE, *Orpheus* SWAINS. (add *Toxostoma* WAGL. and *Harpes* GAMBEL). Bill moderate, compressed, emarginate at the tip. Nostrils basal, oval, placed in a small fossa. Bristles at the angle of mouth. Wings rounded, with fourth and fifth quills, sometimes also sixth, subequal, longest of all. Tail elongate, graduated or rounded, ample.

Sp. *Mimus polyglottus, Turdus polyglottus* L., WILSON *Amer. Ornith.* Pl. x. fig. 1; the *mocking-bird;* back grey, whitish below; wings and tail greyish-black with white on the outside. This North American bird has, with a pleasing and powerful song, the ability also to learn the note of other birds, and even to imitate all kinds of sound;—compare WILSON (JARDINE'S edit.) 1. pp. 164—176. The same ability also belongs to *Mimus orpheus, Turdus orpheus* L., EDWARDS *Birds*, Pl. 78, from the West Indies, and in

[1] *Leiothrix, Fauna Boreali-Amer., Birds*, p. 490.

a greater or less degree to various other South American species.—*Toxostoma* WAGL. Sp. *Mimus rufus, Turdus rufus* L., BUFF. *Pl. enl.* 645; Carolina, &c.

Donacobius SWAINS.

Sp. *Mimus brasiliensis* MAXIM., *Turdus atricapillus* L., BUFF. *Pl. enl.* 392.

Campylorhynchus SPIX. (*Picolaptes* LAFRESN. in part.)

Sp. *Campylorhynchus zonatus, Picolaptes zonatus* LESS. *Cent. Zool.* Pl. 70;—*Campylorh. megalopterus* DESMURS, *Pl. peint.* 54, &c.

Troglodytes VIEILL., KOCH, CUV. Bill moderate (in some shorter than head, in others longer), slender, with culmen subcurved. Nostrils basal, lateral. Gape of mouth produced under the eyes. Wings short, with third, fourth and fifth quills subequal, longest of all. Tail short, rounded or even, often erect.

Sp. *Troglodytes europæus* CUV., *Motacilla troglodytes* L., BUFF. *Pl. enl.* 651, fig. 2, LESS. *Ornith.* Pl. 70, fig. 1, NAUM. Taf. 83, fig. 1; the *common wren, le roitelet, der Zaun-Schlüpfer;* dispersed throughout Europe; a small bird, red-brown, dirty white on the breast; it builds an artistic nest with various materials, especially moss from the trunks of trees, and lays from 6 to 8 white eggs with red spots.

Thryothorus VIEILL. Sp. *Troglodytes longirostris* CUV., VIEILL. *Gal.* Pl. 168, GUÉR. *Iconogr., Ois.* Pl. 15, fig. 1; from Brasil and the Antilles, &c.

Note.—On some other genera, amongst which *Tatare* (!) LESS. ought especially to be noted, cons. GRAY *Gen. of Birds,* I., and BONAP. *Consp. gen. Av.* pp. 220—224.

Family XLVI. *Turdinæ.* Primaries ten, the first very short. Wing-coverts short. Tarsus longer than middle toe, covered on the anterior surface above with a continuous horny coat, below with transverse scutes. Bill emarginate at the tip, compressed, with culmen curved, in most moderate, in a few longer than head.

Copsychus WAGL., *Gryllivora* SWAINS. Bill shorter than head, strong, compressed, with culmen curved. Nostrils lateral, basal, partly covered by the plumules of forehead. Wings with first quill moderate, fourth and fifth or fifth and sixth subequal, longest of all. Tail elongate, cuneate.

Sp. *Copsychus mindanensis, Turdus mindanensis* GM., BUFF. *Pl. enl.* 627; East Indies, the Sunda Islands;—*Copsychus macrourus, Turdus macrourus* GM., *Turdus tricolor* VIEILL. &c.

Bessonornis SMITH. (*Cossypha* VIGORS). Bill short. Wings with fourth, fifth and sixth quills subequal, the fifth longest of all. Tarsi elongate. Tail somewhat long, ample, graduated or rounded. (A genus scarcely distinct from the preceding.)

Sp. *Bessonornis Swainsoni* BONAP., *Petrocincla albicapilla* SWAINSON, *Birds of W. Afr.* I. Pl. 32;—*Bessonornis vociferans, Turdus reclamator* VIEILL. —*Bessonornis semirufa,* RUEPPELL *Syst. Uebers. der Vögel Nord-O. Afr.* 1845, Pl. 21, &c.

Note.—Add genus *Thamnobia* SWAINS. in part, *Thamnolœa* CABAN. They who would unite these three genera will scarcely, in my opinion, violate the natural method.

Sp. *Copsychus albiscapulatus, Saxicola albiscapulata* RUEPPELL, *Neue Wirbelthiere,* Tab. 26, fig. 1. (Comp. *Turdus cinnamomeiventris* LAFRESN., GUÉR. *Magas. de Zool.* 1836, *Ois.* Pl. 55, 56.)

Turdus L. (exclusive of some species). Bill moderate or shorter than head. Nostrils basal, lateral, oval. A few bristles at the angle of mouth. Wings with third and fourth quills, sometimes with fifth also, subequal, the third and fourth longest of all. Tail moderate, even.

The thrushes. These birds feed on insects and worms, in autumn on berries also. They live mostly in woods, and lay from 4 to 7 light-green eggs, commonly spotted with brown or red. The species of Holland and the North of Germany are for the most part birds of passage, but these same species live over the winter in the South of Europe.

Sp. *Turdus musicus* L., BUFF. *Pl. enl.* 406, NAUM. Taf. 66, fig. 2; the *song-thrush* or *throstle, la grive, die Sing-drossel;*—*Turdus pilaris* L., BUFF. *Pl. enl.* 490, NAUM. Taf. 67, fig. 2; the *fieldfare,* &c. These two species are greyish, ruddy-brown above, whitish with black spots below.—*Turdus merula* L., BUFF. *Pl. enl.* 2 male, 555 fem., NAUM. Taf. 71, LESS. *Ornith.* Pl. 38, fig. 1 male; the *blackbird, la merle, die Amsel;* the male black with a yellow bill, the female brownish.

Oreocincla GOULD. Bill moderate, strong, with culmen curved. Tail moderate, rounded, with 14 feathers.

Sp. *Turdus varius* PALL. *Zoogr. Russo-Asiat.* I. 499; central Asia, Japan, occasional in Europe; in this species the third flag-feather is the longest; in a very similar species from Java, *Turdus lunulatus* LATH., SUNDEV., on the contrary, the fourth and fifth flag-feathers are the longest.

Monticola BOIE, *Petrocincla* VIGORS. Bill moderate, with tip curved. Points of wings produced beyond the half of tail.

Sp. *Turdus saxatilis* L., BUFF. *Pl. enl.* 562, NAUM. Taf. 73, *Dict. univ. d'Hist. nat., Ois.* Pl. 18, fig. 2.

Geocichla KUHL.

Sp. *Turdus citrinus* LATH., TEMM. *Pl. col.* 445; from the East Indies, as are also the other species of this sub-genus. Comp. BONAP. *Consp. Gen. Av.* p. 268[1].

Zoothera VIGORS, BONAP. (*Myiophaga* LESS.). Bill longer than head, compressed; upper mandible with hooked tip produced beyond the lower. Wings somewhat short, with first quill very short, fourth and fifth subequal, longest of all. Tail short, even, broad. Tarsus not surpassing middle toe.

Sp. *Zoothera monticola* VIGORS, Himalaya;—*Zoothera andromeda* HARTL., *Myiothera andromeda* TEMM. *Pl. col.* 392; from Timor and the high regions of Java.

Cinclus BECHST., ILLIG., TEMM. (not MOEHR.; see p. 415), *Hydrobata* VIEILL., GRAY. Bill moderate or scarcely shorter than head, cultrate, subascending. Bristles at the angle of mouth none. Nostrils marginal, longitudinal. Tarsus longer than middle toe. Wings short, concave, with first quill very short, third and fourth subequal, longest of all, second scarcely shorter than these. Tail short, even.

Sp. *Cinclus aquaticus* BECHST., *Sturnus cinclus* L., BUFF. *Pl. enl.* 940, LESSON *Ornith.* Pl. 39, fig. 2; the *water-ouzel, der Wasser-Schwätzer;* the back black, the neck and upper part of the breast white, the belly brown. These birds breed twice a year, keep by rivers and brooks, and build artistic nests in holes on the banks; they feed on water-insects. Some species of this genus occur also in Asia and America.

Eupetes TEMM. (Is this its place?) Bill a little longer than head, straight, depressed at the base, broad, with tip curved. Plumes of forehead produced over the lateral fossæ of bill; nostrils basal, oval. Tarsi long, obsoletely scutellate in front. Wings short, rounded, with fifth and sixth quills subequal, longest of all. Tail long, ample, rounded.

Sp. *Eupetes macrocercus* TEMM. *Pl. col.* 516, LESS. *Compl. à* BUFF. VIII. Pl. 39, fig. 2; Sumatra;—*Eupetes Ajax* TEMM. *Pl. col.* 573; New-Guinea, &c. This genus has affinity with *Tanypus* or *Grallina;* see the next page.

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[1] In *Turdus rubiginosus*, a species of this division, the covering of the anterior surface of the tarsi consists of transverse scutes more or less conspicuously distinct.

Family XLVII. *Motacillinæ*. (*Luscinidæ* GRAY, *Sylviadæ* previously.) Primaries in some nine, in others ten (with first very short). Wing-coverts short: Tarsi slender, mostly long, covered anteriorly with distinct transverse scutes, coalesced in some, or with a continuous horny scute. Outer toes conjoined at the base alone. Bill short, more rarely moderate, mostly slender, somewhat straight or subcurved, compressed towards the tip, emarginate.

Grallina VIEILL., *Tanypus*[1] OPPEL. Bill moderate, substraight, with culmen rounded, obscurely emarginate at the tip. Bristles at the angle of mouth. Tarsi long, obscurely scutellate. Toes short. Wings long, with ten primaries, the third and three following subequal, fourth longest of all. Tail long, even, ample at the extremity.

Sp. *Grallina melanolcuca* VIEILL., *Tanypus australis* OPPEL, *Denkschr. der Ak. der Wissensch. zu München*, 1811, 1812, s. 150—166, Tab. VIII, VIEILL. *Gal.* Pl. 150, LESS. *Ornith.* Pl. 39, fig. 1.

Allocoturus mihi, *Enicurus* TEMM. (*Henicurus*). Bill moderate, somewhat straight, dilated at the base, with culmen keeled, tip bent. Nostrils lateral, placed in a fossa, surrounded by membrane. Rigid bristles at the angle of mouth. Wings with ten primaries, first very small, fourth and fifth subequal, longest of all. Tarsi covered anteriorly by a continuous horny scute. Tail elongate, forked, or moderate, deeply emarginate.

Sp. *Allocoturus coronatus, Enic. cor.* TEMM., *Turdus Leschenaultii* VIEILL. *Gal.* Pl. 145, TEMM. *Pl. col.* 113;—*Allocoturus velatus*, TEMM. *Pl. col.* 160; both from Java;—*Allocoturus ruficapillus*, TEMM. *Pl. col.* 534, Sumatra. From the continent of India also, and from central Asia species of this genus are known.

Motacilla L. (exclusive of many species), LATH., BECHST. Bill short, in a few almost as long as head, straight, slender, acuminate, compressed at the tip, emarginate. Nostrils open, basal, lateral, oval, partly covered above by naked membrane. Short bristles at the angle of mouth. Tarsus much longer than middle toe, slender, obsoletely scutellate in front. Front claws small, hind claw longer. Wings with nine primaries, the first two subequal, longest of all,

[1] Such also is the name given by MEIGEN to a genus of the *Diptera*, I. p. 345.

with the sixth and seventh of secondaries long. Tail elongate, even.

Sp. *Motacilla alba* L., BUFF. *Pl. enl.* 652, LESS. *Ornith.* Pl. 71, fig. 1; *the pied wagtail, la hoche queue, la lavandière, die weisse Bachstelze;* grey, white below, the two outer tail-feathers white, the throat in the summer-plumage, especially in the adult male, pitch-black. A somewhat different species, occurring chiefly in England, is *Motacilla Yarrellii* GOULD, which was confounded by previous writers with *Motac. lugubris* PALL.; it is figured under this name in GUÉRIN *Iconogr., Ois.* Pl. 15, fig. 3.—In some of the species the toe of the hallux is long and very acute. Of these CUVIER forms the sub-genus *Budytes.*—Sp. *Motacilla flava* L., BUFF. *Pl. enl.* 674, fig. 2, CUV. *R. Ani., éd. ill., Ois.* Pl. 29, fig. 2; *the yellow wagtail,* &c. They make the transition to the following genus.

Anthus BECHST., TEMM. (species of gen. *Alauda* L.). Bill short, with culmen declivous at the base, then somewhat straight, subcurved, subemarginate, acuminate, mostly slender. Nostrils placed before the base of bill, oval, marginal. Tarsus longer than middle toe, scutellate anteriorly. Front toes moderate, posterior toe elongate, surpassing hallux, acute. Wings with nine primaries, second and third longest of all; with the sixth and seventh of the secondaries long. Tail moderate, emarginate.

These birds have the closest affinity with the preceding; in the colour and marking of the feathers they, however, have more resemblance to the larks and many thrushes, grey-brown above, and the breast spotted black. They feed on insects alone. Sp. *Anthus pratensis* BECHST., *Alauda pratensis* L., BUFF. *Pl. enl.* 660, fig. 2, NAUM. Taf. 84, figs. 3, 85, fig. 1; *the tit-lark, meadow-pipit.*—*Anthus arboreus* BECHST., *Alauda trivialis* L., BUFF. *Pl. enl.* 660, fig. 1, LESS. *Ornith.* Pl. 71, fig. 2, GUÉR. *Iconogr., Ois.* Pl. 15, fig. 5, NAUM. Taf. 84, fig. 2; the *tree-pipit,* &c. Species of this genus from all parts of the world are known. To it belong also the sub-genera *Agrodoma* SWAINS. and *Corydalla* VIG.

Exochocichla nob., *Henicocichla* GRAY, *Sejurus* SWAINS. (Species of *Motacilla* L., GMEL.)

Sp. *Exochocichla auricapilla, Motacilla auricapilla* L., *Turdus auricapillus* WILS. *Am. Ornith.* Pl. 14, fig. 2;—*Exochocichla noveboracensis, Motacilla noveboracensis* GM., *Turdus aquaticus* WILS. l. l. Pl. 23, fig. 5, &c.

Accentor BECHST., ILLIG., TEMM. Bill short, broad at the base, with culmen declivous at the base, then somewhat straight, subulate, compressed at the tip, emarginate. Bristles at the angle of mouth. Nostrils at the base of bill, linear, narrow, surrounded by membrane. Tarsi scutellate anteriorly, with scutella sometimes

obsolete. Wings with ten primaries, the third, fourth and fifth subequal, the fourth longest of all. Tail moderate, subemarginate.

Sp. *Accentor modularis, Motacilla modularis* L., BUFF. *Pl. enl.* 615, fig. 1, " NAUM. Taf. 92, figs. 3, 4, *the hedge Accentor, hedge warbler;—Accentor alpinus* BECHST., *Motacilla alpina* GM., BUFF. *Pl. enl.* 668, fig. 2, NAUM. Taf. 92, fig. 1, LESSON *Ornith.* Pl. 69, fig. 2, &c. These birds feed in winter principally on seeds of plants, in summer on insects also.

Sialia SWAINS. Bill short, with tip curved. Tarsus covered anteriorly with a continuous horny scute. Wings long, with ten primaries, the first very small, the second, third and fourth subequal, the third longest of all. Tail somewhat short, subeven.

Sp. *Sialia Wilsonii* SWAINS., *Motacilla sialis* L., BUFF. *Pl. enl.* 396, GUÉR. *Iconogr., Ois.* Pl. 4, fig. 1, WILSON *Am. Ornith.* Pl. 3, fig. 5;—*Siala arctica* SWAINS., RICHARDSON *Faun. Bor. Am., Birds,* Pl. 39, North America.

Note.—Here are to be inserted some genera of recent writers: *Petroica* SWAINS. &c.

Saxicola BECHST., TEMM. (Species of *Motacilla* L.) Bill short, broader than high at the base, almost straight, with culmen keeled, continued above the forehead, bent at the tip, obscurely emarginate. Bristles at the base of bill, inflected downwards. Nostrils lateral, basal, oval, partly covered by membrane. Tarsus elongate, slender, covered anteriorly with a continuous scute. Posterior claw arched, shorter than hallux. Wings long, with ten primaries, the first small, second long, third and fourth subequal, longest of all. Tail even, short.

Sp. *Saxicola œnanthe* BECHST., *Motacilla œnanthe* L., BUFF. *Pl. enl.* 554, figs. 1, 2; NAUM. Taf. 89, figs. 1, 2; *the wheat-ear, le motteux, der Steinschmätzer.—Saxicola stapazina, Motac. stapazina* L., *Dict. univ. d'Hist. nat., Ois.* Pl. 35, fig. 2.

Sub-genus *Pratincola* KOCH. Sp. *Saxicola rubicola, Motacilla rubicola* L., *Pl. enl.* 678, fig. 1, LESS. *Ornith.* Pl. 68, fig. 1, (under the erroneous name of *Œnanthe*), NAUM. Taf. 90, figs. 1, 2, &c.—Small, lively and shy birds, feeding on insects; there is often a great difference in the sexes in respect to colour and marking. All the species belong to the Eastern hemisphere, the most to Africa.

Luscinia BRISS., BREHM. (*Lusciola* BLAS. and KEYSERL., spec. of *Motacilla* L., spec. of *Sylvia* LATH., TEMM.). Bill short, broad at the base, with culmen curved, keeled, compressed at the tip, emarginate. Nostrils oval, placed at the anterior margin of a

membranous fossa in the base of bill. Short bristles along the posterior margin of lower mandible. Wings with ten primaries, second moderate, third, fourth and fifth subequal, fourth mostly longest of all. Tarsus longer than middle toe, covered anteriorly with a continuous horny scute. Tail moderate or somewhat long, mostly even.

Calliope GOULD (and *Cyanecula* BRISS.). Bill acuminate, somewhat straight, with tip curved. Wings moderate, with first quill reaching nearly to the middle of second, third and fourth subequal, longest of all. Tarsi elongate. Tail moderate, even or rounded.

Sp. *Luscinia cyanecula, Motacilla suecica* L., BUFF. *Pl. enl.* 361, fig. 2, 610, figs. 1, 2, NAUM. Taf. 75, figs. 3—5;—*Luscinia calliope, Motacilla calliope* PALL., *Accentor calliope* TEMM., *Dict. univ. d'Hist. nat., Ois.* Pl. 35, fig. 1.

Rubecula BRISS., BREHM, *Dandalus* BOIE. Bill acuminate, with culmen subcurved, with tip acute, curved. Wings with first quill produced to the middle of second, third quill not equalling the sixth, fourth and fifth sub-equal, longest of all. Tail moderate, emarginate.

Sp. *Luscinia rubecula, Motacilla rubecula* L., BUFF. *Pl. enl.* 360, fig. 1, NAUM. Taf. 75, figs. 1, 2; the *red-breast.*

Ruticilla BREHM, *Phœnicura* SWAINS. Bill with culmen depressed before nostrils, broad at the base at the sides of mouth. Wings somewhat long, with first quill small, third, fourth and fifth subequal, fourth longest of all. Tail longer, even.

Sp. *Luscinia phœnicurus, Motacilla phœnicurus* L., BUFF. *Pl. enl.* 351, figs. 1, 2, NAUM. Taf. 79, figs. 1, 2; the *red-start.*—*Luscinia tithys, Motacilla erythacus* L. (and *Motac. titys* L., *Syst. nat.* ed. X?), NAUM. l. l. figs. 3, 4.

Luscinia GRAY, *Philomela* BREHM. Bill with culmen subcurved, rounded towards the tip. Wings moderate, with first quill very short, narrow, third and fourth subequal, fifth much shorter than these, third longest of all. Tail moderate, with sides rounded.

Sp. *Luscinia vulgaris* nob., *Motacilla luscinia* L., BUFF. *Pl. enl.* 615, fig. 2, LESSON *Ornith.* Pl. 69, fig. 1, NAUM. Taf. 74, fig. 2; the *nightingale, le Rossignol,* &c.; back ruddy brown, breast ash-grey, belly whitish; plumage the same in the two sexes. This little bird feeds on insects, small worms, &c.; its beautiful, rich and clear song has gained from ancient times a well-deserved celebrity.

Sylvia LATH. (in part). Bill short, depressed at the base, with culmen keeled, emarginate at the tip. Nostrils basal, placed in a

fossa. Bristles at the angle of the mouth and the base of the bill. Tarsi scarcely longer than middle toe, scutellate anteriorly. Wings with ten primaries, the first very small, third and fourth longest of all, subequal. Tail moderate, rounded, broad.

We here adopt the genus *Sylvia* in the same extension as GRAY, and refer to it the genera *Hippolais* BREHM, *Phyllopneuste* MEYER and WOLF, &c. All the species are from the Eastern hemisphere.

Ficedula KOCH, BLAS. and KEYSERL. (*Phyllopneuste* MEYER). Tail subemarginate or even. Tarsus longer than middle toe. Bill depressed at the base, broader than high.

a) *With first quill very small, second, third and fourth subequal, third longest of all.*

Sp. *Sylvia sibilatrix* BECHST., TEMM. *Pl. col.* 245, fig. 3; NAUM. Taf. 80, fig. 2; the *wood-wren;* light brownish-green above, yellowish below, a yellow streak above the eyes;—*Sylvia hippolais, Motacilla hippolais* L., *Pl. enl.* 581, fig. 2, NAUM. Taf. 80, fig. 1, *Hippolais icterina* DESMURS, *Pl. peint.* 57, fig. 1; the *chiffchaff* (from the two notes of its song)[1].

b) *With first quill produced beyond the third part of the second, with second shorter than the four following quills, the third, fourth and fifth longest of all.*

Sp. *Sylvia rufa* LATH., NAUM. Taf. 80, fig. 4; also named *chiff-chaff*[2].

Sylvia BLAS. and KEYSERL. Tail even or rounded. Tarsus not longer than middle toe. Bill at the base higher than broad.

a) *With wings rounded, the second quill not equalling the sixth.* (*Pyrophthalma* BONAP.)

Sp. *Sylvia melanocephala, Motacilla melanocephala* GM.;—*Sylvia sarda* MARMORA, TEMM. *Pl. col.* 24, fig. 2, &c.

b) *With wings acuminate, the second quill surpassing the sixth, sometimes scarcely shorter than the third or fourth the longest of all.*

Sp. *Sylvia cinerea* BRISS., *Motacilla sylvia* L., BUFF. *Pl. enl.* 579, fig. 3, 581, fig. 1, NAUM. Taf. 78, figs. 1, 2; the *white-throat*, &c. Here also belongs the genus *Curruca* BRISS., BREHM.

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[1] The genus *Hippolais* of BREHM, which, according to him, ought to be placed in the neighbourhood of *Calamoherpe*.

[2] Comp. JENYNS *Man. of Brit. Vert. Anim.* p. 112. "Having compared our English *S. Hippolais* with the *S. rufa* of TEMMINCK (the specimen having been named by TEMMINCK himself, and sent by him to Mr GOULD, to whose kindness I am indebted for it), and found them agreeing closely in all their characters, I have no hesitation in considering them of the same species."

Calamoherpe MEYER, *Salicaria*; SELBY, BLAS. and KEYSERL. Bill shorter than head, somewhat straight, emarginate obscurely at the tip. Short bristles at the angle of mouth. Nostrils basal, placed in a fossa, surrounded by membrane. Forehead depressed, continuous with the base of bill. Tarsi long, scutellate. Claw of hallux strong, curved, larger than the rest. Wings with ten primaries, the first very small, the second, third and fourth subequal, third longest of all. Tail moderate, rounded or graduated.

Sp. *Calamoherpe turdina, Turdus arundinaceus* L., BUFF. *Pl. enl.* 513, NAUM. Taf. 81, fig. 1; the *reed-wren, die Rohrdrossel;* above ruddy-grey, below whitish, the lower mandible yellow at the base;—*Calamoherpe arundinacea, Motacilla arundinacea* GM., NAUM. Taf. 81, fig. 2; the *small reed-wren,* very similar to the preceding, but smaller; these birds feed on water-insects.

Note.—Add allied genera *Acrocephalus* NAUM., *Aëdon* BOIE, *Cinclorhamphus* GOULD, and some others omitted here.

Crateropus SWAINS.

Drymoica SWAINS. (add *Megalurus* HORSF., *Prinia* ejusd. (and *Cisticola* LESS.). Bill short, with culmen curved, keeled, with tip compressed, emarginate. Short bristles at the angle of mouth. Nostrils placed in a fossa at the base of mouth, surrounded by membrane. Wings short, rounded, with ten primaries, the first short or moderate, the fourth and fifth (in some the fifth and sixth) longest of all. Tail elongate, graduated. Tarsi long, scutellate anteriorly. Hallux with claw large, curved.

Sp. *Drymoica maculosa* GRAY, *Sylvia macroura* LATH., BUFF. *Pl. enl.* 752, fig. 2;—*Drymoica superciliosa* SWAINS. *Birds of W. Afr.* II. Pl. 2;—*Drymoica clamans, Prinia clamans* RUEPP. *Atl.* Taf. 2, fig. *a,* TEMM. *Pl. color.* 466, fig. 2, &c.

On some other genera, to be inserted here: *Sphenœacus* STRICKLAND, *Sphenura* LICHTENST., *Dasyornis* VIG., HORSF., *Manorhina* VIEILL., *Psophodes* HORSF., cons. GRAY *Gen. of Birds,* I., and BONAP. *Consp.* pp. 279 and 216.

Orthonyx TEMM. Bill short, emarginate, compressed, with culmen curved and keeled. Nostrils lateral, placed in a pit at the base of bill. Tarsi elongate, strong, scutellate anteriorly; outer toe almost equalling middle; claws strong, little curved, compressed.

Wings short, concave, with first quill moderate, fifth and sixth subequal, longest of all. Tail moderate, rounded.

Sp. *Orthonyx spinicaudatus* TEMM. *Pl. color.* 428, 429; New Zealand, South Sea Islands; brown, white below; the shafts of the tail-feathers projecting, pointed. These birds climb on trees in quest of insects. Another species of bird from New Holland, referred to this genus, differs not only in its colours, but also in having longer wings; *Orthonyx icterocephalus* LAFRESN., *Certhia heteroclita* QUOY and GAIMARD, GUÉRIN *Magas. de Zool.* 1839, *Ois.* Pl. 8.

Malurus VIEILL. Bill short, with gape ample, culmen keeled, tip curved, often emarginate, compressed. Bristles at the angle of mouth. Nostrils placed in a large fossa, surrounded by membrane. Tarsi long, covered anteriorly with a continuous horny scute, slender. Wings moderate or short, with ten primaries, the first short, or moderate, the fourth, fifth and sixth subequal, longest of all. Tail graduated, narrow.

Sp. *Malurus cyaneus* VIEILL., *Motac. cyanea* VIEILL. *Gal.* Pl. 163;—*Malurus Lambertii* VIG. and HORSF., WHITE *Journal*, Pl. 41, PHILLIP *Voy. to Bot. Bay*, Pl. 23; all the species are from New Holland or Van Diemen's Land; the males are distinguished by lively colours.

Stipiturus LESS. Tail-feathers long, rigid, acuminate, with vane decomposed.

Sp. *Malurus palustris* VIEILL., *Muscicapa malachura* SHAW, *Linn. Trans.* IV. Pl. 21; from the southern part of Australia.

Orthotomus HORSF., *Edela* LESS. Bill depressed at the base, somewhat straight, slender, moderate (or in some long). Wings short, rounded, with ten primaries, the fourth, fifth and sixth subequal, fifth longest of all. Tail of various length, mostly moderate or somewhat long, graduated, with feathers narrow. Tarsi long, slender, scutellate anteriorly.

Sp. *Orthotomus Bennettii* SYKES, *Motacilla longicauda* (and *sutoria*) GMEL., LAFRESNAYE in GUÉRIN *Magas. de Zool.* 1836, *Ois.* Pl. 52;—*Orthot. edela* TEMM., *Edela ruficeps* LESS., TEMM. *Pl. color.*, LAFRESN. l. l. Pl. 51, &c. Small birds from the East Indies, the first species noticed is known under the name of *tailor-bird* (*Sylvia sutoria*), from its nest of two or three mango-leaves sewed together with cotton-thread, filled internally with cotton and down; see MARTINET *Katech. der Natuur.* II. p. 194, Pl. 4, PENNANT *Indian Zool.* London, 1790, Pl. 10, p. 44, LAFRESN. l. l. Pl. 53; Ceylon, China, &c. (It is probable, however, that this mode of nest-making is to be ascribed to more than one species of this genus.)

Sylvicola SWAINS. Bill shorter than head, conical, slender, broad at the base, compressed at the tip, obscurely emarginate. Nostrils placed in a broad fossa at the base of bill. Bristles at the angle of mouth. Wings with nine primaries, the first scarcely shorter than the two following, the longest of all. Tail moderate, subeven. Tarsi covered anteriorly with transverse scutes, sometimes scarcely distinct, longer than middle toe. Outer toe longer than inner.

Sp. *Sylvicola coronata, Motacilla coronata* L. (and *Motac. canadensis* L. sp. 27), BUFF. *Pl. enl.* 709, fig. 1, WILSON *Am. Ornith.* Pl. 17, fig. 4, Pl. 45, fig. 3.

Sylvicola canadensis, Motac. canad. L. (sp. 42), BUFF. *Pl. enl.* 685, fig. 2, WILS. *Am. Ornith.* Pl. 15, fig. 7, &c. All the species of this genus are from America, the most from North America.

Mniotilta VIEILL. Bill almost of the length of head, with culmen subarched. Hallux larger than the other toes, with claw curved. Tail subemarginate.

Sp. *Sylvicola varia, Motacilla varia* L., *Figuier varié* BRISS. *Ornith.* III. Pl. 27, fig. 5, EDWARDS *Gleanings*, Pl. 300, VIEILL. *Gal.* Pl. 169, WILSON *Am. Ornith.* I. Pl. 19, fig. 3; this bird from the southern part of North America, occurring also in the West Indies, creeps in the winter months like *Certhia*, on the stem and branches of trees in quest of insects, and pecks at the moss with its bill, a peculiarity from which VIEILLOT has derived the name *Mniotilta*.

Trichas SWAINS., (not GLOGER, *Geothlypis* CABAN.). Bill moderate, compressed, subulate, the gape armed with bristles. Wings with first quill not equalling the fourth, third longest of all. Tail rounded. (Other characters almost of the preceding genus. Tarsus far surpassing the middle toe.)

Sp. *Trichas personata, Turdus trichas* L., *Motacilla trichas* GMEL., BUFF. *Pl. enl.* 709, fig. 2, WILSON *Am. Ornith.* Pl. 6, fig. 1.

Setophaga SWAINS.

On the species of this genus and on some other genera of this place, here omitted, consult BONAP. *Consp.* p. 312 and foll.

Family XLVIII. *Muscicapinæ*. Primaries ten, the first short. Wing-coverts short. Tarsi covered anteriorly with transverse scutes, posteriorly and on both sides with a continuous scute. Bill broad at the base, with tip curved, emarginate. Rigid bristles at the base of bill.

Muscicapa L. (in part), CUV. Bill short, with culmen keeled. Nostrils basal, lateral, partly covered by bristles. Feet moderate; tarsus of the length of middle toe. Hind claw curved, larger than middle fore claw. Wings moderate or somewhat long, with third and fourth quills longest of all, scarcely surpassing the second. Tail moderate, subeven.

Sp. *Muscicapa grisola* L. (*Butalis grisola* BOIE), BUFF. *Pl. enl.* 565, fig. 1, NAUM. Taf. 64, fig. 1; the *spotted fly-catcher, le gobe mouche, der Fliegenfänger;* feeds on flying insects, generally taking them in its flight; lays four or five light blue-green eggs with red spots;—*Muscicapa atricapilla* L., and *Muscicapa albicollis* TEMM., CUV. *R. Ani., éd. ill., Ois.* Pl. 18, fig. 1, have been observed only rarely in Holland, and belong rather to the south of Europe (especially the last-named[1]). From Abyssinia is *Muscicapa fumigata* GUÉR., *Muscicapa chocolatina* RUEPPELL, *System. Uebers.* Tab. 20, &c.—Also in China and Japan species of this genus occur. Sp. *Muscicapa narcissina* TEMM. *Pl. col.* 577, fig. 1, (the genus *Xanthopygia* BLYTH, BONAP.).

Hemichelidon HODGS.

Comp. *Annals of nat. Hist.* 1845, p. 203, GRAY *Gen.* I., *Muscicapinæ.*

Note.—On some other genera of modern writers, *Chaitaris* (*Niltava*) HODGS., *Dimorpha*, &c., see GRAY, l. l. Add *Chasiempis* CABAN., *Arch. f. Naturg.* 1847, pp. 207, 208.

Muscipeta CUV. (in part), CABAN., *Tchitrea* LESS., GRAY. Bill moderate, depressed at the base, broader than high. Long bristles at the base of bill. Wings with fourth and fifth quills subequal, longest of all. Tail long, graduated or cuneate (with two middle feathers in males very long).

Sp. *Muscipeta paradisi, Muscicapa paradisi* L., BUFF. *Pl. enl.* 234, figs. 1, 2; East Indies;—*Muscipeta rufa* SWAINS., BUFF. *Pl. enl.* 248, fig. 1, LESSON *Ornith.* Pl. 42, fig. 1;—*Muscipeta princeps* TEMM. *Pl. col.* 584, Japan;—*Muscipeta cristata, Muscicapa cristata* GM., BUFF. *Pl. enl.* 573, fig. 2, South Africa;—*Muscipeta rufiventris* SWAINS. *Birds of W. Afr.* II. Pl. 4, &c.

Platystira JARD.

Drymophila TEMM. (not SWAINS.) *Monarcha* VIG. and HORSF. Bill moderate, strong, with culmen keeled. Nostrils basal, lateral,

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[1] They form the genus *Muscicapa* BOIE, named *Hydomela* by SUNDEVALL, because he thinks the name *Muscicapa* should be kept for *Butalis* BOIE. *Öfvers af Kongl. Vet. Akad. Förh.* 1846, pp. 223—225.

covered with the silken plumules of the forehead. Gape of mouth beset with long bristles. Tarsus equalling middle toe in length. Wings with third quill subequal to the fourth the longest of all. Tail moderate, even or subemarginate, sometimes rather long, graduated.

Sp. *Drymophila carinata, Muscipeta carinata* SWAINS., TEMM. *Pl. col.* 413, fig. 2;—*Drymophila trivirgata* TEMM. l. l. fig. 1;—*Drymophila velata* TEMM. Pl. 334, &c. Species from Timor, Sumatra, New Guinea and Australia.

Prosorinia HODGS., *Oreas* TEMM. (*Cochoa* HODGS. previously, GRAY.) Bill moderate, depressed, broad at the base, with culmen arched, keeled. Nostrils lateral, placed in a fossa. Wings long, with third and fourth quills subequal, fourth longest of all. Tail somewhat long, graduated.

Sp. *Prosorinia azurea, Turdus azureus* TEMM. *Pl. col.* 274;—*Prosorinia viridis, Cochoa viridis* GRAY, *Gen.* Pl. LXVIII. &c.

Pericrocotus BOIE, *Acis* LESSON. Bill shorter than head, broad at the base, with culmen subcurved. Nostrils basal, placed in a fossa, covered by plumules of forehead produced over the bill. Wings moderate, with fourth and fifth quills subequal, longest of all. Tail long, with three outer feathers on each side graduated, the four middle subequal.

Sp. *Pericrocotus miniatus, Muscicapa miniata* TEMM. *Pl. color.* 156, *Dict. univ. d'Hist. nat., Ois.* Pl. 2B, fig. 2; Java;—*Pericrocotus peregrinus, Parus peregrinus* L. (*Syst. nat.* ed. XII. 1, p. 342, and *Motacilla cinnamomea* ejusd.? p. 335) &c.

Ceblepyris CUV. (and *Graucalus* ejusd.), *Campephaga* VIEILL., GRAY. Bill shorter than head, or short, strong, broad at the base, with culmen curved, keeled; a few bristles at the angle of mouth. Nostrils basal, lateral, placed in a fossa, partly covered by plumules. Wings with third and fourth quills subequal, longest of all. Tail somewhat long, rounded. Feathers of back and rump rigid, often spinescent.

Compare, on this genus, TEMMINCK in the text of the *Pl. color.* Livr. 42 (Vol. III. opposite Pl. 278) and RUEPPELL *Monographie der Vögelgattung, deren Typus* LEVAILLANT *unter dem Namen* "les Echenilleurs," *bekannt gemacht hat. Mus. Senckenb.* III. 1845, pp. 17—39. All the species are from warm countries of the Eastern hemisphere. They feed on caterpillars and other insects living upon trees. The larger species with stronger bill, and of which the two sexes do not differ in plumage, form the sub-genus

Graucalus. Sp. *Ceblepyris melanops, Corvus melanops* LATH., GUÉR. *Iconogr., Ois.* Pl. 6, fig. 2; Australia, New Guinea, Timor;—*Ceblepyris lineata, Corvus Novæ Guineæ* LATH., BUFF. *Pl. enl.* 629; Sumatra, &c. Smaller species, of which the males often have a plumage with metallic lustre, belong to the sub-genus *Ceblepyris.* Sp. *Ceblepyris phœniceus, Turdus phœniceus* LATH., TEMM. *Pl. col.* 71, ISID. GEOFFR. in GUÉR. *Mag. de Zool.* 1833, *Ois.* Pl. 9, SWAINS. *Birds of W. Afr.* Pl. 27, 28, Senegal.—*Ceblepyris cæsia, Campephaga cana* VIEILL. *Galer.* Pl. 130, &c.

Note.—On the sub-genera *Lalage* BOIE (*Erucivora* SWAINS.) and *Volvocivora* HODGS., comp. BONAP. *Consp. gen. Av.* pp. 355, 356.

Ptilogonys SWAINS., *Hypothymis* LICHTENST. Bill short, depressed, with culmen keeled, curved, compressed at the tip. Nostrils placed in a fossa at the sides of bill, surrounded by membrane, partly covered by plumules. Feet short; tarsus shorter than middle toe, plumed below the heel. Toes moderate; hallux short, strong. Claws moderate, curved, compressed. Wings moderate, with first quill very short, fourth, fifth and sixth subequal, fifth longest of all. Tail even, elongate, broad at the apex.

Sp. *Ptilogonys cinereus* SWAINS., *Hypothymis chrysorrhœa* LICHTENST., TEMM. *Pl. col.* 452, Mexico;—*Ptilogonys leucotis* TSCHUDI, *Faun. Peruan.* Taf. VII. fig. 1, &c.

Myiadestes SWAINS. Sp. *Ptilogonys armillatus, Muscicapa armillata* (VIEILL.), *Myiadestes genibarbis* SWAINS., GRAY *Gen.* Pl. LXIX., from the Antilles.

Bombicilla BRISS., VIEILL. Bill short, broad at the base, thick, subcurved. Nostrils basal, oval, mostly covered by rigid, decumbent plumes. Feet short, with tarsi partly scutellate posteriorly. Wings somewhat long, with first quill very short, second and third subequal, third longest of all. Tail short, subeven. Head crested. (An anomalous genus.)

Sp. *Bombicilla Garrula, Ampelis Garrulus* L., BUFF. *Pl. enl.* 261, LESS. *Ornith.* Pl. 56, fig. 2, NAUM. Taf. 59, CUV. *R. Ani., éd. ill., Ois.* Pl. 20, fig. 1; *Bohemian chatterer, Bohemian wax-wing, le jaseur de Bohème, der Seidenschwanz;* general colour reddish-grey, belly silver-grey, tail black, tipped with yellow; flag-feather black with white spots, throat black, and a black streak behind the eyes. Some of the secondaries terminate in a horny lamina of a deep red. Little is known of its habits; the food consists of insects and berries. This species is also found in North America, in some parts of Asia and in Japan. In North America another very similar species is also found, *Bombycilla cedrorum* VIEILL. *Gal.* Pl. 118, WILS. *Am. Ornith.* Tab. 7, fig. 1; and at Japan is a third, of which the tail is not yellow at the extremity, but crimson-red, *Bombycilla*

phœnicoptera TEMM. *Pl. col.* 450, *Faun. Japon., Av.* Tab. 44. This species has no horny plates on the wings.

Family XLIX. *Laniinæ.* (*Laniadæ* D'ORB. and LAFRESN., CABAN.) Primaries mostly ten (with first short, more rarely very short), in a few nine. Wing-coverts short. Tarsi moderate or short, covered anteriorly with transverse scutes, at the sides with a continuous scute. Bill short or moderate, strong, compressed, emarginate towards the tip or furnished with a tooth on each side.

Edolius CUV., *Dicrurus* VIEILL., GRAY. Bill moderate, thick, broad at the base, with culmen keeled, bent, compressed towards the tip, emarginate. Upper mandible produced beyond the lower. Long bristles at the base of bill. Nostrils basal, lateral, rounded, covered by bristles and plumules. Wings somewhat long, with first three quills gradually longer, fourth and fifth longest of all. Tail with ten feathers, elongate, almost always forked. Feet short.

Sp. *Edolius balicassius, Corvus balicassius* L., BUFF. *Pl. enl.* 603, Malacca; —*Edolius cristatus, Lanius forficatus* L., BUFF. *Pl. enl.* 189, Madagascar; —*Edolius malabaricus, Lanius malabaricus* LATH., SONNER. *Voy. aux Ind. Or.* Pl. 97; CUV. *R. Ani., éd. ill., Ois.* Pl. 23, fig. 1;—*Edolius remifer* TEMM. *Pl. col.* 178. In the two last-named Indian species the outer tail-feather in the male is very long, and in the last is more than twice the length of the body; these two outermost feathers are vaned only at the extremity. In *Edolius remifer* the tail, with the exception of the outer feather, is even at the extremity. The colour of most of the species is black with steel-blue reflections.

Irena HORSF. (Species of *Graucalus* CUV.) Bill moderate, strong, broad at the base, compressed towards the tip, emarginate, with culmen keeled, curved. Nostrils lateral, covered by plumules and bristles. Bristles at the base and angle of mouth. Tarsi short, scutellate. Wings with first quill narrow, short, the third a little shorter than fourth and fifth, which are longest of all. Tail moderate or somewhat short, broad, even, with twelve feathers.

Sp. *Irena puella* HORSF., *Zool. Researches in Java*, I. 1821, *Coracias puella* LATH., TEMM. *Pl. col.* 70 male, 225 fem., 426 young bird; from Malacca, Sumatra, &c.; dark black with clear cobalt-blue on the back and on the top of the head;—*Irena cyanogaster* VIG., GRAY *Gen. of Birds*, Pl. LXX. Manilla.

Trichophorus TEMM., *Trichas* GLOGER (not SWAINS.). Bill short or moderate, elongate and conical, somewhat broad at the

base, with tip curved, emarginate. Nostrils placed in front of the base of bill, open, oval. Very long bristles at the base of bill. Feet short; tarsus not longer than middle toe. Wings moderate, with first three quills gradually longer, fourth, fifth and sixth longest of all. Tail somewhat long, broad, even or rounded.

Sp. *Trichophorus barbatus* TEMM. *Pl. col.* 88; greyish-green with thick yellow feathers under the throat, and a crest of long bristly hairs at the back of the head; from the coast of Guinea, as are some other species. Some also are known from India and the Sunda Islands. Comp. BONAP. *Conspect. gen. Av.* p. 262.

Phyllastrephus SWAINS.

Comp. SWAINSON in App. to *Fauna boreali-Amer.* II. 1831, p. 486. All the species are from Africa. Here belongs *Turdus senegalensis* GM., BUFF. *Pl. enl.* 563, fig. 2.

Pycnonotus KUHL, *Ixos* TEMM., *Brachypus* SWAINS. Bill short, broad at the base, with culmen curved, keeled. Nostrils placed in a fossa, linear, lateral. Bristles at the sides of mouth. Tarsi short, thick, booted or obscurely scutellate. Wings with fourth and fifth quills subequal, longest of all. Tail somewhat long, rounded or even, with the apex broad.

† *With bill serrate towards the tip with four or three notches.* (*Tarsi scutellate. Tail even.*) Sub-gen. *Andropadus* SWAINS., *Polyodon* LAFRESNAYE.

Sp. *Pycnonotus importunus, Turdus importunus* VIEILL., LAFRESNAYE in GUÉRIN *Magasin de Zoolog.* 1832, *Ois.* Pl. 4; Cape of Good Hope.

†† *With bill emarginate towards the tip once only.* (*Tarsi covered in front with confluent scutella, scarcely distinct or with a continuous scute. Tail rounded.*) *Pycnonotus* auct. (*Brachypus, Hæmatornis* SWAINS.)

Sp. *Pycnonotus jocosus, Lanius jocosus* L., BRISS. *Ornith.* II. Pl. 21, fig. 2, BUFF. *Pl. enl.* 508, SONNER. *Voy. aux Ind. Or.* Pl. 98 (fig. bad), DIXON *Voy. round the World,* p. 358 and Pl.; China and India. (This species seems to be *Ixos pyrrhotis* of HODGSON; another very similar species is smaller and has the hinder part of the body yellowish, *Pycnonotus jocosus* BLYTH, BONAP.) These two species are ruddy-brown above, white below; they have a red spot below the eyes, the head crested.—*Pycnonotus cafer* L., BRISS. *Ornith.* II. Pl. 20, fig. 2, BUFF. *Pl. enl.* 563, fig. 1; South Africa. In these species the coverts under the base of the tail are red, in other species yellow. *Pycnonotus melanocephalus, Lanius melanocephalus* GM., *Ixos atriceps* TEMM. *Pl. col.* 147; yellow-green with shining black head; from the Sunda Islands, &c.

Spasornis mihi[1], *Vanga* VIEILL., GRAY. Bill moderate, straight, compressed, higher than broad, strong, with culmen obtuse, keeled, with tip curved; each mandible emarginate towards the tip. Angle of mouth armed with bristles. Nostrils lateral, basal, rounded, partly covered by plumules. Tarsi longer than middle toe, scutellate anteriorly. Wings with fourth, fifth and sixth quills subequal, longest of all. Tail somewhat long, graduated.

Sp. *Spasornis curvirostris, Lanius curvirostris* L., BRISS. *Ornith.* II. Pl. 19, fig. 1; BUFF. *Pl. enl.* 228; Madagascar. This bird resembles in miniature some species of *Barita*, as *Barita varia* (*Cracticus*), p. 487, but differs on the first inspection by the round form of the nostrils.

Lanius L. (excl. of some species.) Bill moderate or short, strong, compressed, higher than broad, mostly curved, furnished with a tooth on each side towards the tip. Nostrils placed at the base of bill or a little in front of the base, often covered by bristles. Tarsi longer than middle toe, scutellate anteriorly. Wings moderate, with first quill short, third and fourth mostly subequal, longest of all. Tail somewhat long or moderate.

Falcunculus VIEILL. Bill short, curved, much compressed, with keel produced amongst the feathers of forehead. Wings with fourth and fifth quills longest of all. Tail even or subemarginate. Tarsi moderate.

Sp. *Lanius frontatus* LATH., TEMM. *Pl. col.* 77, CUV. *R. Ani., éd. ill., Ois.* Pl. 16, fig. 1; Australia; of the size of *Lanius collurio*, and almost similarly coloured to *Parus major*. The feathers of the head form a crest.

Prionops VIEILL. Bill curved, moderate. Erect plumes of head forming a compressed crest, produced beyond the base of bill. Wings long, with fourth, fifth and sixth quills subequal, fifth longest of all. Tail somewhat long, rounded.

Sp. *Lanius plumatus* SHAW, *Prionops Geoffroyi*, VIEILL. *Gal.* Pl. 142, LESS. *Ornith.* Pl. 44, fig. 1, SWAINS. *Birds of W. Afr.* I. Pl. 26; Senegal; white, the wings and tail black, with a white streak on the wings; a naked ring round the eyes, the legs pale yellow (in the other species of this family they are commonly black like the bill).—*Lanius poliocephalus, Prionops cristatus* RUEPP. &c.

Lanius auct. Bill curved. Wings with third and fourth quills subequal, longest of all. Tail somewhat long, rounded or cuneate.

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[1] From $\sigma\pi\acute{a}\omega$, to draw off, to tear.

Sp. *Lanius excubitor* L., BUFF. *Pl. enl.* 445, LESS. *Ornith.* Pl. 45, fig. 1, NAUM. Taf. 49; the *cinereous shrike, la pie-grièche, der graue Würger*, grey above, white below, the middle of the tail, the wings and a streak on each side of the bill over the eyes black;—*Lanius collurio* L., BUFF. *Pl. enl.* 31, fig. 1 fem., 2 male, NAUM. Taf. 52; the *red-backed shrike, der rothrückige Würger;* back and wings cinnamon-brown, head of male grey, the third flag-feather the longest, &c. Most of the species are birds of passage in Europe. These birds are very predaceous; they feed on beetles, grasshoppers, &c.; on small birds also and mice, and attach their prey to branches or transfix it, especially the insects, on thorns. They all build a moderately artistic nest, and lay from 5 to 7 yellow-white or light-green eggs, which have darker spots, especially at the obtuse end.

Telephorus SWAINS. Bill moderate or a little longer than head, much compressed, curved, with culmen produced amongst the plumes of forehead. Wings short, with fourth and fifth quills longest of all. Tail broad, graduated, long.

Sp. *Lanius erythropterus* SHAW, BUFF. *Pl. enl.* 479, fig. 1, *Tchagra* LEVAILL., Senegal;—*Lanius cucullatus* TEMM., SUSEMIHL *Vög. Europa's*, II. Tab. 17, fig. 2, Spain, &c. (This sub-genus is in the wings, &c. more aberrant from the type of the *Lanii* than the others. Upon this the following genus closes, which has very long tarsi.)

Malaconotus SWAINS., *Laniarius* VIEILL., BONAP. Bill moderate or shorter than head, much compressed, with culmen somewhat curved, tip curved, produced beyond the lower mandible, which is shorter. Tarsi long. Wings with fourth, fifth and sixth quills longest of all. Tail mostly long, rounded.

Sp. *Malaconotus barbarus, Lanius barbarus* L., BUFF. *Pl. enl.* 56, SWAINS. *Birds of W. Afr.* I. Pl. 24, Senegal;—*Malaconotus torquatus, Lanius gutturalis* DAUD., *Dict. univ. d'Hist. Nat., Ois.*, Pl. 2 A, fig. 2; South Africa, &c.

Sub-genus *Dryoscopus* BOIE, BONAP. Sp. *Malaconotus mollissimus* SWAINS., *Lanius gambensis* LICHTENST., SWAINS. *Birds of W. Afr.* I. Pl. 23, &c.

Note.—*Lanius bicolor* L., BUFF. *Pl. enl.* 298, fig. 1, scarcely of this genus, differs by the tail shorter and the third and fourth quill-feathers subequal, longest of all.

Pachycephala SWAINS. Bill moderate or short, thick, with culmen curved, compressed towards the tip, emarginate. Bristles at the angle of mouth. Tarsi somewhat long, scutellate anteriorly. Wings with fourth and fifth quills longest of all. Tail even or subrotundate.

Sp. *Pachycephala pectoralis, Muscicapa pectoralis* LATH., *Pachycephala fusca* VIG. and HORSF., *Linn. Transact.* XV. p. 240; from Australia, as are most of the species, of which figures are to be found in GOULD'S *Birds of Australia*. A couple of species occur also at the Moluccan Islands.

Sub-gen. *Eopsaltria* SWAINS. Bill moderate, abruptly curved at the tip.

Sp. *Pachycephala australis* VIG. and HORSF., *Motacilla australis* LATH., WHITE *New South Wales*, Pl. 28, p. 239.

Hyloterpe CABAN., *Hylocharis* BOIE. Bill short, inflated at the sides. Wings with fifth and sixth quills longest of all.

Sp. *Pachycephala philomela* Mus. L. B.; Borneo, Java;—*Pachycephala orpheus* JARDINE *Contributions to Ornith.* 1849, Pl. 37, Timor.

Ptererythrius STRICKL., *Pteruthius* SWAINS., *Allotrius* MUELL. Bill short, with tip curved, hooked. Nostrils basal, placed in a fossa, pervious. Bristles at the base of bill. Tarsi long, booted or obscurely scutellate. Wings with third, fourth and fifth quills longest of all. Tail short, graduated.

Sp. *Ptererythrius flavipennis, Allotrius flaviscapis* TEMM. *Pl. col.* 589, fig. 1, Java;—*Ptererythrius œnobarbus, Allotrius œnobarbus* TEMM. ib. fig. 2, &c.

Pardalotus VIEILL., TEMM. (Is this its place?) Bill short, dilated at the base, compressed towards the tip, emarginate, with culmen distinct, curved. Nostrils basal, lateral, small, surrounded by membrane. Feet slender; tarsus longer than middle toe, covered anteriorly with transverse scutella. Wings with nine primaries, the first three subequal, the second longest of all. Tail short, broad, even.

Sp. *Pardalotus punctatus, Pipra punctata* LATH., TEMM. *Pl. col.* 78, CUV. *R. Ani., éd. ill., Ois.* Pl. 16, fig. 2;—*Pardalotus ornatus* TEMM., *Pipra striata* LATH., TEMM. *Pl. col.* 394, fig. 1; these species, like most of the others, are from New Holland; one species from Timor is also known.

Vireo VIEILL. Bill short or moderate, strong, with culmen keeled, subcurved, emarginate at the tip, compressed. Short bristles at the angle of mouth. Nostrils basal, placed in a fossa. Feet somewhat short; tarsus longer than middle toe, covered anteriorly with transverse scutes. Wings with either ten primaries, the first very short, or nine (in this case the second and third, in

that the third and fourth longest of all). Tail even or subemarginate.

a) With nine primaries. (*Vireosylvia* BONAP., *Phyllomanes* CABAN.) Wings with second quill (which in the others is the third) longest of all.

Sp. *Vireo olivaceus* VIEILL., *Muscicapa olivacea* L., WILS. *Am. Ornith.* Pl. 12, fig. 3; common in the forests of North America.—*Vireo virescens* VIEILL., GRAY *Gen. of Birds*, Pl. LXV.; the south-west of North America, Guyana.

b) With ten primaries. (*Vireo* BONAP.)

Sp. *Vireo noveboracensis, Muscicapa noveboracensis* GM., WILS. *Am. Ornith.* Pl. 18, fig. 6;—*Vireo solitarius* VIEILL., WILS. ib. Pl. 17, fig. 6, &c.

Ocypterus CUV., *Artamus* VIEILL., GRAY. Bill short or scarcely shorter than head, curved, with culmen rounded. Nostrils basal. Tarsi strong, scarcely shorter than middle toe. Toes strong, short, with claws curved, compressed, acute. Wings long, with first quill very small, second longest of all. Tail even, moderate or somewhat short.

Sp. *Ocypterus albovittatus* CUV., *Turdus sordidus* LATH. (and *tenebrosus* ejusd.) CUV. *R. Ani., éd. ill., Ois.* Pl. 3, fig. 6, LESS. *Ornith.* Pl. 44, fig. 2; Australia;—*Ocypterus leucorhynchus, Lanius leucorhynchus* GM., BUFF. *Pl. enl.* 9, fig. 1, Java, Celebes, &c. Compare on this genus VALENCIENNES *Observ. sur le genre des Langrayens, Mém. du Mus.* VI. 1820, pp. 20—27, Pl. 7—9. It is placed by CABANIS with *Oriolus*, and appears in some sense to stand in the middle between that genus and *Lanius* (and *Hirundo?*).

Family L. *Chelidones* (*Hirundinidæ* GRAY). Wings long, acute, with nine primaries in some, in others ten. Wing-coverts mostly short. Tarsi short, covered anteriorly with transverse scutes, often hirsute. Hallux shorter than the inner toe. Bill short, broad at the base, depressed, entire at the tip, compressed, curved. Gape of mouth in the plumed part of head produced as far as under the eyes.

The *swallows* have especially long, pointed wings, and fly very rapidly and continuously to capture insects as they fly for food. For this purpose the bill, of which the horny part is unusually short, can be opened very wide. They build their nests mostly in society, and lay from four to six eggs. In our parts all the species of this family are birds of passage. This family may be separated into two divisions, which were united by LINNÆUS under his genus *Hirundo*, yet, with much resemblance, still so greatly differ from each other, that most modern writers have found occasion to remove

them far apart. The first division alone possesses special muscles for song, as in the rest of the singing birds.

Section I. *Hirundininæ.* Wings with nine primaries, the first longest of all; secondaries moderate, hidden at the base alone by short coverts. Tail-feathers twelve.

Hirundo L. (in part[1]). Characters of the section. Fore toes three, the middle much longer than the side-toes. Claws acute, compressed, slender. Tail mostly forked.

a) *With tarsi naked.*

* *With bill somewhat strong, culmen curved.*

Progne Boie, *Cecropis* Less. (Species all American.)

Sp. *Hirundo purpurea* L. (and *H. Subis* ejusd.) Buff. *Pl. enl.* 722, Wils. *Amer. Ornith.* 2, Pl. 39, figs. 2, 3; in North and South America;—*Hirundo chalibæa* Gm., Buff. *Pl. enl.* 545, fig. 2.

** *With bill weak, depressed, very broad at the base.*

Cotyle Boie, *Biblis* Less. add *Herse* in part. Wings longer than tail. Tail emarginate, or subeven.

Sp. *Hirundo riparia* L., Buff. *Pl. enl.* 543, fig. 2, Naum. Taf. 146, figs. 3, 4;—*Hirundo tapera* L., Brisson *Ornith.* II. Pl. 45, fig. 3; South America, &c.

Hirundo. (*Cecropis* Boie, *Athicora* Boie, Gray). Tail forked, with outermost feathers sometimes very long.

Sp. *Hirundo rustica* L., Buff. *Pl. enl.* 543, fig. 1, Naum. Taf. 145, fig. 1; the *chimney-swallow, die Rauchschwalbe;* the largest native species; bluish-black above, the throat ruddy, the belly white, a white spot on each of the tail-feathers at the inner side, except the two innermost, which are not spotted. It prefers making its nest in cow-houses.—*Hirundo senegalensis* L., Buff. *Pl. enl.* 310, Swains. *Birds of W. Afr.* I. Tab. 6; the largest species, shining black above, ruddy on the belly and hind part of back.

b) *With tarsi and toes hirsute.*

Chelidon Boie. (Tail forked, with feathers gradually decreasing up to the innermost, the outermost moderate.)

Sp. *Hirundo urbica* L., Buff. *Pl. enl.* 542, fig. 2, Less. *Ornith.* Pl. 34, fig. 2, Naum. Taf. 145, fig. 2; the *house-martin, l'hirondelle de fenêtre, die Hausschwalbe;* black above, white below and also on the rump; tarsi and toes covered with white down; this species builds a nest of mud on the

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[1] *Hirundo apus, Hir. melba* and *Hir. esculenta* L., belong to *Cypselus; Hirundo pratincola* L. is *Glareola,* see above p. 412.

outside on walls, lines it with feathers, and lays from four to six white eggs. Another species, *Hirundo dasypus* TEMM., is found at Borneo.

Section II. *Cypselinæ*. Wings with ten primaries, either with the first two quills subequal, longest of all, or with the second surpassing the first (more rarely the first the second). Secondaries short, hidden by coverts nearly to the extremity. Tail with ten feathers.

Cypselus ILLIG. (characters of the section). Bill short, with culmen distinct, curved. Feet short. (Toes almost equal, the three anterior composed of three phalanges.) Wings very long, with quills narrow.

Callocalia GRAY. Three toes facing forward, hallux backward. Wings with second quill longest of all. Tail moderate, even or subemarginate.

Sp. *Cypselus esculentus, Hirundo esculenta* L., BRISS. *Ornith.* II. Tab. 46, fig. 2, Amboyna;—*Cypselus nidificus, Hirundo nidifica* LATH., *Hirundo fuciphaga* SHAW; Ceylon, Borneo, Sumatra, &c. Species of which the nests are glutinous and eatable. Compare V. SCHEERBRAND in *Arch. f. Naturgesch.* 1840, s. 393.

Cypselus ILLIG., GRAY et recent. Tarsi hirsute. Hallux turned forwards (*pedes adhamantes*) or versatile. Wings with second quill longest of all, in some with first two subequal. Tail forked.

Sp. *Cypselus murarius* TEMM., *Hirundo Apus* L., BUFF. *Pl. enl.* 542, fig. 1, LESS. *Ornith.* Pl. 34, fig. 1, NAUM. Taf. 147, fig. 2; the *common swift, le martinet, die Thurmschwalbe;* brown-black with white throat; Europe, North Africa;—*Cypselus alpinus* TEMM., *Hirundo melba* L., VIEILL. *Gal.* Pl. 121, NAUM. Taf. 147, fig. 1; South of Europe, Africa to the Cape; larger, grey-brown, with throat and hind part of body white.

Cypselus cayennensis, Hirundo cayennensis GM., BUFF. *Pl. enl.* 725, fig. 2; in this South American species not only the tarsi, but also the toes are entirely feathered; CABANIS forms from it his genus *Panyptila.*

Acanthyllis BOIE, *Pallene* LESS., *Hemiprocne* NITZSCH. Three toes anterior; hallux posterior. Tarsi naked. Tail even, short, with feathers naked at the points, pungent or acuminate.

Sp. *Acanthyllis senex, Cypselus senex* TEMM. *Pl. col.* 397; Brasil; brown with head grey, the tail-feathers terminating in points, but the shafts not projecting; the second flag-feather is the longest, the first shorter than the third. In the other species the shafts of the tail-feathers terminate in sharp points; the first flag-feather is the longest or at least longer than the

third. Sp. *Acanthyllis pelasgia, Hirundo pelasgia* L., WILS. *Am. Orn.* Pl. 39, fig. 1;—*Acanthyllis collaris, Hirundo albicollis* VIEILL. *Gal.* Pl. 120, *Pl. col.* 195;—*Acanthyllis spinicauda, Cypselus spinicaudatus* TEMM., BUFF. *Pl. enl.* 726, fig. 1.

Dendrochelidon BOIE (*Macropterus* s. *Macropteryx* SWAINS., *Pallestre* LESS.). Three toes anterior; hallux posterior. Tarsi in some naked, in others hirsute. Wings very long, with first two feathers subequal. Tail forked.

Sp. a) Outer tail-feathers longer than wings. Bill depressed, flat, very broad at the base. Wings with first quill longest of all. *Dendrochelidon mystacina, Cypselus mystaceus* LESS. *Voy. Coquille, Ois.* Pl. 22, *Dict. univ. d'Hist. nat., Ois.* Pl. 3, fig. 1; New Guinea.

b) Point of wing produced beyond the outer tail-feathers. Bill with culmen curved.

† Wings with first quill longest of all.

Sp. *Dendrochelidon comata, Cypselus comatus* TEMM. *Pl. col.* 286; Sumatra, Borneo.

†† Wings with second quill longest of all.

Sp. *Dendrochelidon longipennis, Hirundo Klecho* HORSF., TEMM., *Pl. col.* 83; Java, Sumatra, &c.

Family LI. *Nyctichelidones* (*Caprimulgidæ* BONAP., GRAY). Wings long, with ten primaries. Wing-coverts long. Plumage lax, soft. Head broad, flat above. Bill curved, short; gape of mouth large, descending below the eyes. Tarsi mostly short, strong, scutellate anteriorly, often hirsute. Tail with ten feathers.

A) *With outer toe short (only four phalanges); with claw of middle toe dilated internally, incised pectinately.*

Caprimulgus L. Bill very short, flexile, depressed at the base, broad, compressed at the tip and bent into a round hook. Rigid bristles, thick at the base, placed in a row along the upper margin of gape, directed forwards. Nostrils basal, approximate, subtubular. Anterior toes conjoined at the base by membrane, outer toe short, middle long, with claw pectinately incised. Hallux short, versatile. Wings elongate, with second quill mostly the longest of all. Tail various in form, in several elongate.

The *goat-suckers*. These nocturnal birds bear, according to the remark of LINNÆUS, the same relation to the swallows that the owls do to the

falcons[1]. They form in some respects the transition to the nocturnal birds of prey (to the genus *Strix* L.), and feed upon beetles and moths.

* *With tail long, even or rounded.*

Sp. *Caprimulgus europæus* L., BUFF. *Pl. enl.* 193, LESS. *Ornith.* Pl. 33, fig. 2, NAUM. Taf. 148; the *European goat-sucker, night-jar, l'engoulevent, die Nachtschwalbe, der Ziegenmelker;* the colours of the loose feathers present in this and in the other species of this genus a mixture of black, brown, yellow and white streaks and spots; this native species lays two dirty-white eggs with grey-brown spots on the ground, making no nest.—*Caprimulgus ruficollis* TEMM., SUSEMIHL, VI. Taf. 3; South of Europe, Africa.

Note.—Add sub-genera *Eurostopodus* GOULD and *Lyncornis* ejusd.

** *Tail long, very broad, rounded or even. (Wings with second and third quills longest of all.* Sub-genus *Anthrostomus* GOULD.)

Sp. *Caprimulgus cayanensis* GM., BUFF. *Pl. enl.* 760;—*Caprimulgus guianensis* GM., BUFF. *Pl. enl.* 733; from South America;—*Caprimulgus carolinensis* BRISS., WILS. *Am. Orn.* II. Pl. 54, fig. 2; from North America.

*** *Tail long, graduated, with two middle feathers very long. (Scortornis* SWAINS. or *Scotornis?)*

Comp. on this group CASSIN *Monograph of the Birds composing the genera Hydropsalis* WAGLER *and Anthrostomus* NATTALL; *Journal of the Acad. of Nat. Sciences of Philad., Second Ser.* II. 1850, 1854, pp. 113—124, Pl. XIII.

Sp. *Caprimulgus climacurus* VIEILL. *Gal.* Pl. 122; Senegal, coast of Guinea.

**** *Tail forked, with outermost feathers often very long. (Psalurus* SWAINS., *Hydropsalis* WAGL.)

Sp. *Caprimulgus psalurus* TEMM., *Capr. furcifer* GRAY, not VIEILL., TEMM. *Pl. col.* 157, 158; Brasil.

Chordeiles SWAINS. Bill very small. Wings longer than tail, acute, with first two quills longest of all. Tarsi short. Tail long, forked or emarginate, more rarely subeven.

Sp. *Caprimulgus americanus* L., *Caprimulgus acutus* GM., BUFF. *Pl. enl.* 722;—*Caprimulgus virginianus* BRISS., *Caprimulgus americanus* WILS. *Am. Ornith.* Pl. 40, &c. All the species are from the Western hemisphere.

Eleothreptus GRAY, *Amblypterus* GOULD. Wings with first quill somewhat short, second and following up to the sixth nearly equal, falcate, seventh and eighth longest of all. Tail short, even.

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[1] *Caprimulgus* genere differt ab *Hirundine*, uti *Strix* a *Falcone*, *Phalæna* a *Papilione*. *Syst. nat.* ed. XII. Tom. I. p. 346.

Sp. *Caprimulgus anomalus* GOULD, *Proceed. Zool. Soc.* 1837, p. 105, *Icon. av.* Tab. 1. (I have not seen this species); South Amer.

Macrodipteryx SWAINS. Wings long, with second quill surpassing all, except the last primary in males, which is very long, and with the middle of the stem naked, the tip vaned.

Sp. *Caprimulgus longipennis* SHAW, *Macrodipteryx africanus* SWAINS. *Birds of W. Afr.* II. Pl. 5.

Podager WAGL., *Proïthera* SWAINS. Wings long, with first quill longest of all, extended beyond the extremity of tail. Tail moderate or somewhat short, even, broad.

Sp. *Caprimulgus Nattereri* TEMM. *Pl. col.* 107;—*Caprimulgus diurnus* MAXIM., *Caprimulgus nacunda* VIEILL., TEMM. *Pl. col.* 182;—*Caprimulgus Gouldi*, *Podager Gouldi* GRAY *Gener.* Pl. XVIII.; species from South America.

B) *With outer toe longer than inner; with claw of middle toe entire.* (*Base of bill covered by setaceous, decomposed plumules.*)

Nyctibius VIEILL. Bill broad, narrowed at the tip, with lower mandible much curved and bent down towards the tip. Nostrils lateral. Wings with second and third quills longest of all. Tail long, rounded or even. Tarsi very short, strong. Toes conjoined at the base by membrane. Claws curved, compressed.

Sp. *Nyctibius grandis*, *Caprimulgus grandis* GM., BUFF. *Pl. enl.* 335, GRAY *Gen.* Pl. XVI.—*Nyctibius leucopterus* MAXIM., DESM. *Pl. peint.* 49, &c.; all species from South America.

Ægotheles VIGORS. Bill small, broad at the base, with the tip of both mandibles bent down. Decomposed, divergent, erect plumes at the base of bill. Toes free. Wings with third and fourth quills longest of all. Tail long, graduated.

Sp. *Ægotheles novæ Hollandiæ* VIG., *Caprimulgus novæ Hollandiæ* LATH., WHITE *New S. Wales*, Pl. 29, p. 241, PHILLIP *Bot. Bay*, Pl. 42, p. 270, LAFRESNAYE in GUÉRIN *Magas. de Zool.* 1837, *Ois.* Pl. 82. This species, and another also later discovered (*Ægotheles leucogaster* GOULD), is found in New Holland. This genus is more closely allied to *Podargus* than to *Caprimulgus*.

Podargus CUV.[1] Bill broader at the base than forehead, with culmen convex, tip hooked; upper mandible by its margin over-

[1] *R. Ani.* 1817, Tom. IV. *Corrections et Additions*, p. 172.

lapping lower. Nostrils lateral, remote from the base, partly closed by a horny scale, covered by plumes of forehead. Wings with fourth and fifth quills (or even sixth) subequal, longest of all. Tail long, mostly graduated, sometimes rounded. Toes free, padded beneath.

Sp. *Podargus cinereus* CUV., *R. Ani.* Pl. 4, fig. 1, LESS. *Ornith.* Pl. 33, fig. 1, GUÉR. *Iconogr., Ois.* Pl. 17, fig. 4, &c. Species from New Holland and New Guinea. Small species are found at the Sunda Islands, in which the sixth quill-feather is as long or even longer than the fifth. They form the genus *Batrachostomus* GOULD. Sp. *Podargus cornutus* TEMM. *Pl. col.* 159.

Steatornis HUMBOLDT. Bill moderate, curved, dentate before the tip, with tip produced, uncinate. Nostrils lateral, placed nearly in the middle of bill, oblique. Wings long, with third and fourth quills longest of all. Tail long, graduated, broad. Tarsi strong, short, hirsute. Toes free, with claws compressed, curved.

Sp. *Steatornis caripensis* HUMBOLDT, *Observ. de Zool. et d'Anat. comp.* II. pp. 139—144, Tab. 44 (fig. of head and of foot), L'HERMINIER in *Nouv. Ann. du Mus. d'Hist. nat.* III. 1834, pp. 321—331, Pl. 15 (fig. of bird col.), J. MUELLER *Anat. Bemerkungen, Arch. f. Anat. Physiol.* &c. 1842, s. 1—11, Taf. 1; the *Guacharo*, a large, red-brown, nocturnal bird, living in caverns of Cumana, which is said to feed exclusively on fruits; its oily fat is used by the natives in dressing their food. The double vocal organ is noticed above, p. 344.

(Genus of uncertain position.) *Eurylaimus* HORSF. Bill shorter than head or moderate, depressed, broader at the base than forehead, with culmen rounded, tip curved; margin of upper mandible waved. Bristles or decomposed feathers at the sides of upper mandible. Feet moderate; tarsi scutellate anteriorly. Outer toes concrete as far as the second phalanx. Wings moderate, with third and fourth quills longest of all. Tail with twelve feathers, graduated.

a) *Nostrils longitudinal, lateral, median, placed in a groove. Cymbirhynchus* VIG., *Erolla* LESS. Sp. *Eurylaimus nasutus* TEMM., *Todus macrorhynchus* GM., TEMM. *Pl. col.* 154, GUÉRIN *Iconogr., Ois.* Pl. 16, fig. 3, Sumatra, Borneo.

b) *Nostrils basal, rounded. Eurylaimus* HORSF., GRAY. (*Corydon* LESS., *Platyrhynchus* VIEILL., add *Parisomus* SWAINS. and *Serilophus* ejusd.) Sp. *Eurylaimus corydon* TEMM., *Eurylaimus sumatranus* VIG., *Pl. col.* 297, LESS. *Ornith.* Pl. 50, fig. 1; *Eurylaimus Horsfieldi* TEMM., *Eurylaimus javanicus* HORSF., *Pl. col.* 130, 131, &c.

Add genus *Peltops* WAGL., which differs by the bill being less broad, the toes less concrete, the tail forked.

Sp. *Eurylaimus Blainvillii* GARNOT, *Voy. Coq., Ois.* Pl. 19, fig. 2; from New Guinea.

ORDER VI. *Raptatores.*

Bill hooked, compressed, cerigerous at the base, with nostrils open. Feet strong, with toes padded beneath, scabrous, with the three anterior connected at the base only or entirely cloven, with hallux large, posterior. Claws elongate, strong, curved. Primaries ten. Wing-coverts large. Tail with twelve or fourteen feathers.

Section I. *Aves rapaces nocturnæ.*

Bill short, covered at the base by recumbent setæ. Nostrils placed at the anterior margin of cere. Head large, densely plumed, with eyes large, turned forward. Tarsi reticulate with scales, covered with dense plumes (often the toes also woolly); outer toe shorter than inner (yet with five phalanges), versatile. (First quill-feathers ciliated externally, with barbs separate at the point, recurved.)

Family LII. *Strigidæ.* (Characters of the section those also of the single family.)

The *nocturnal birds of prey* or owls form a very natural family, with LINNÆUS a single genus, *Strix*, in which he recognised only 12 species, which, however, are now multiplied more than tenfold. The owls seek their prey mostly by twilight, and also by night in moon-light; it consists of small mammals, of birds, which they mostly surprise sleeping, and also of large insects; some species eat frogs also. The principal food, however, of the owls consists of the various species of the mouse genus. The females are commonly somewhat larger than the males; in other respects there is little difference between the two sexes. They lay only few eggs (from 2 to 5), of a white colour.

The feathers of the owls are very soft, whence these birds fly without noise. The anterior part of the head is covered with plumules with loose branches (they are sometimes even hairy); they surround the eyes radiately, and thus form on the head a kind of veil (*discus*) more or less complete; round this disc lies a wreath

consisting of some rows of short curved plumules, which descend behind the auditory apertures and meet below the lower mandible. The auditory apertures are usually large, and in some are covered by a fold of skin found at their anterior margin.

The cranial bones are highly pneumatic and have a large circumference. The *furcula* becomes thin below and sometimes even membranous, as in some climbing birds. The sternum has below on each side two incisures in most species, in some a single one. Two large cœca are present. Compare J. J. KAUP, *Uebersicht der Eulen*, OKEN'S *Isis*, 1848, s. 753—772; *Monograph. of the Owls—Strigidæ*, in JARDINE'S *Contrib. to Ornith.* 1851, pp. 119—130, 1852, pp. 103—122; T. CASSIN, *Descriptions of Owls, presumed to be new species, in the collection of the Academy of Nat. Sciences of Philadelphia; Journal of the Acad. of Nat. Sc. of Philad.; sec. Series*, II. 1850—1854, pp. 51 and foll. 95 foll. Pl. III—V. and Pl. XII.

Strix SAVIGNY, GRAY, KAUP, *Hybris* NITZSCH[1]. Bill subcurved at the base, curved at the tip. Facial disc complete. Bunches of plumes at the sides of forehead none. Wings long, extended beyond the extremity of tail, with second quill longest of all. Tail short, subeven or rounded. Tarsi longer than middle toe, slender, plumed. Toes scutellate anteriorly.

Sp. *Strix flammea* L., BUFF. *Pl. enl.* 440, GUÉR. *Iconogr., Ois.* Pl. 4, fig. 2, NAUM. Taf. 47, fig. 2, SUSEMIHL *Vögel Europa's*, Taf. 46; the *white owl, l'effraye, der Schleierkautz, die Thurmeile;* the bill in this and other species of this genus is somewhat larger than in the rest of the owls, slightly curved at the base and more strongly only near the tip. The feathers of the face, or the disc, are pure white; the belly light rust-colour or dirty white; the back and wings brown and ruddy with white and black spots. This species is dispersed throughout nearly the whole of Europe, the north of Africa and western Asia. It makes its nest in the roofs of old buildings, churches, towers, &c. A very similar species lives in North America (*Strix pratincola* BONAP., *Strix flammea* WILS.), and another, larger, in Cuba, *Strix perlata* LICHTENST., *Strix furcata* TEMM., *Pl. col.* 432. From South Africa also, from India and especially from Australia, some species of this genus are known.

Ulula KEYSERL. and BLAS. (*Ulula* CUV. and *Syrnium* SAVIGNY, CUV.) Bundles of feathers at forehead none. Auditory apertures large, lunate, furnished at the interior margin with a cover. Wings moderate, with third and fourth, or fourth and fifth quills longest of all. Tail rounded or subeven, produced beyond the points of wings. Tarsi and toes plumed.

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[1] ὕβρις, a nocturnal bird of prey; ARISTOT. *Hist. an.* IX. 12.

Sp. *Ulula aluco, Strix aluco* L., (and *Strix stridula* ejusd.), BUFF. *Pl. enl.* 437, 441, NAUM. Taf. 46, 47, fig. 1, SUSEM. *Vög. Eur.* Taf. 45; the *tawny owl, le chat huant, la hulotte, der Waldkautz;—Ulula cinerea, Strix cinerea* GM., *Strix barbata* PALL. *Zoogr. Rosso-Asiat.* Fasc. 3, Tab. 1;—*Ulula hylophila, Strix hylophila* TEMM., *Pl. col.* 373, DESMURS, *Pl. peint.* 37 (*Strix fasciata*); Brasil, Chili, &c.

A large species from the North and East of Europe and North-western Asia, with tail longer than in the other species, forms the genus *Ptynx* BLYTH: *Ulula uralensis* PALL., *Strix liturata* RETZ., TEMM. *Pl. col.* 27, NAUM. Taf. 42, fig. 1, SUSEM. *Vög. Eur.* Taf. 42.

Nyctale BREHM, *Scotophilus* SWAINS. (Characters almost of the preceding genus, but the opening of nostrils is smaller, and furnished with only a rudiment of operculum. Wings with third and fourth quills longest of all.)

Sp. *Ulula funerea, Strix funerea* L., *Strix Tengmalmi* GM., VIEILL. *Gal.* Pl. 23, NAUM. Taf. 48, figs. 2, 3; SUSEM. *Vög. Eur.* Taf. 48; from the North of Europe and Asia, rare in England (named by BEWICK the *little owl*). Some species resembling it are found in America.

Otus CUV. (excl. of some spec.), GRAY, *Ægolius* KEYSERL. and BLAS. Two tufts of feathers at the sides of forehead, standing out like ears. Auricular aperture large, lunate. Wings long, with second and third quills longest of all. Tail moderate, even. Tarsi short, plumed, as are the toes.

Sp. *Otus vulgaris* FLEM., *Strix Otus* L., BUFF. *Pl. enl.* 29, NAUM. Taf. 45, fig. 1; the *long-eared owl, le hibou commun, le moyen duc, die Ohreule;* Siberia, Europe, Egypt;—*Otus brachyotus, Strix brachyotos* FORSTER[1], GMEL., BUFF. *Pl. enl.* 438, NAUM. Taf. 45, fig. 2, SUSEM. *Vög. Eur.* Taf. 51; the *short-eared owl, la chouette;* Europe, N. Africa, some parts of Asia (and North America?); the ear-tufts, consisting only of two or three plumules, are small and, since they are not always erect, readily escape notice; they are placed close together on the top of the head; it is an incorrect statement that they occur only in males.

†† *Facial disc incomplete, deficient above the eyes.*

Bubo CUV., *Asio* SWAINS. Aperture of ears moderate, lunate. Two tufts of longer plumes standing out at the sides of forehead. Wings with third and fourth quills longest of all.

Ketupa LESS., GRAY. Wings produced at the extremity scarcely beyond the middle of tail. Tarsi naked, reticulate. Toes naked,

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[1] *Philos. Transact.* LXII. p. 284, No. 2; *Strix ægolius, ulula* and *accipitrina* PALL. Perhaps, however, the North American species (that of FORSTER) is different; it is figured in WILSON *Am. Ornith.* Pl. 53, fig. 3.

furnished above the base of claws with a few transverse scutella, elsewhere reticulate.

Sp. *Bubo ceylonensis, Strix ceylonensis* GM., *Strix Leschenaultii* TEMM. *Pl. col.* 20;—*Bubo Ketupa, Strix Ketupa* HORSF., *Strix ceylonensis* TEMM. *Pl. col.* 74.

Bubo CUV. (in stricter sense). Upper mandible with margin sinuate. Wings not produced as far as the end of tail. Tarsi and toes clothed with dense plumes.

Sp. *Bubo europæus* LESS., *Strix Bubo* L., BUFF. *Pl. enl.* 435, LESS. *Ornith.* Pl. 17, fig. 1, NAUM. Taf. 44; the *eagle owl, le grand duc;* the largest species of this family; it lives in the extensive forests of Germany, Italy, Hungary and Russia; rare in France, extremely rare in England;—*Bubo lacteus, Strix lactea* TEMM. *Pl. col.* 4, from N. Africa, &c.

Ephialtes KEYSERL. and BLAS., *Scops* SAVIGNY. Wings produced beyond the end of tail. Tarsi clothed with short plumes, toes naked. (Species small.)

Sp. *Bubo scops, Strix scops* L., BUFF. *Pl. enl.* 486, NAUM. Taf. 43, fig. 3; the *scops-eared owl, le petit duc, die Zwerg-ohreule;* South of Europe, North of Africa; rare in England, has not been observed in Holland; in the colour and marking of the feathers this bird is not unlike the wry-neck (*Yunx torquilla*); it is not larger than a thrush.—*Bubo atricapillus, Strix atricapilla* NATTERER, TEMM. *Pl. col.* 145, South America, &c.

Phodilus ISID. GEOFFR.[1] Bill somewhat straight at the base, curved at the tip. Tufts of feathers above the forehead none. Wings with fourth, fifth and sixth quills subequal, longest of all. Tail very short, rounded. Tarsi feathered. Toes long, reticulate at the upper part, at the lower above the base of claws scutellate anteriorly, with scattered hairs.

Sp. *Phodilus badius, Strix badia* HORSF., TEMM. *Pl. col.* 318; Java, Sumatra; this species has much external resemblance to *Strix flammea.*

Surnia DUMÉRIL, KEYSERL. and BLAS. Facial disc incomplete, sometimes almost obsolete. Aperture of ears oval, moderate or small, without cutaneous fold. Tufts of plumes above the forehead none. Wings with second, third and fourth quills sinuately narrowed externally, the third quill longest of all. Tarsi and often toes also densely plumed.

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[1] *Ann. des Sc. nat.* XXI. 1830, pp. 194—203.

Nyctea STEPHENS. Wings with second and fourth quill subequal, scarcely shorter than third, produced beyond the middle of tail. Tail somewhat short, subrounded. Toes densely plumed.

Sp. *Surnia nivea, Strix nyctea* L., BUFF. *Pl. enl.* 458, NAUM. Taf. 41, SUSEM. *Vög. Eur.* Taf. 41; the *snowy owl, le Harfang;* a large species, white with some grey-brown spots and streaks, from the North of Europe and America (found in the Orkney Islands, very rare in Holland and England). The sternum has only a single incision behind on each side.

Athene BOIE (add *Glaucidium* ejusd.), GRAY. Wings with second quill short. Tail moderate or somewhat short, subeven.

* *Toes with setaceous, scattered plumes.*

Sp. *Surnia noctua, Strix noctua* RETZ., *Strix passerina* CUV., BUFF. *Pl. enl.* 439, NAUM. Taf. 48, fig. 1, SUSEM. *Vög. Eur.* Taf. 46; the *little owl, little night-owl, la chevèche commune, der Steinkautz;* a small species from the middle and South of Europe, North America, and Western Asia;—*Surnia brama, Strix brama* TEMMINCK, *Pl. col.* 68, &c.

** *Toes densely plumed.* (*Glaucidium* BOIE.)

Sp. *Surnia passerina, Strix passerina* L., *Strix acadica* TEMM., NAUM. Taf. 43, figs. 1, 2, SUSEM. *Vög. Eur.* Taf. 43, fig. 2; Sweden, Switzerland, Russia; the smallest species of this family.

Surnia DUMÉRIL (in stricter sense). Tail long, graduated. Toes densely plumed.

Sp. *Surnia ulula, Strix ulula* L., *Strix funerea* LATH., *Strix nisoria* MEYER, BUFF. *Pl. enl.* 63, WILSON *Am. Orn.* Pl. 50, fig. 6, 42, fig. 2, SUSEM. *Vögel Eur.* Taf. 43, fig. 1; the *hawk-owl, little hawk-owl, Canada owl, Chouette épervier, Chouette à longue queue, die Sperbereule.* This species, from the North and East of Europe, Siberia and North America, approaches in its mode of life, and also in form, to the diurnal birds of prey, especially to the *Kites;* it does not fly by night, but morning and evening, sometimes even during the day.

Section II. *Aves rapaces diurnæ.* Base of bill covered by cere. Eyes lateral. Outer toe not shorter than inner, mostly longer.

Family LIII. *Accipitrinæ.* Bill moderate or shorter than head, hooked, mostly bent in an arch from the base downwards, with margin of upper mandible often dentigerous. Nostrils lateral, rounded or oval, placed in the cere, open. Eyes with upper margin covered by crowded plumes. Head almost always densely plumed.

The genus *Falco* of LINNÆUS. On these birds may be consulted J. J. KAUP *Monographien der Falconidæ,* in OKEN'S *Isis,* 1847 (s. 39—80,

s. 83—121, s. 161—212, s. 241—283, 325—386, and, with some alterations, translated as a short extract in JARDINE'S *Contrib. to Ornith.* 1849, 1850; and on this family as well as on the whole order: J. F. BRANDT *Die Gruppen und Gattungen der Raubvögel Russlands,* in the *Journal für Ornith.* edited by J. CABANIS, 1853, s. 178—195, s. 225—240.

The *falcons* are very numerous. Their skeleton differs from that of the nocturnal birds of prey in many characters; the form of the skull is quite different, and it is only slightly pneumatic, the *furcula* is strong, broad and expanded, the sternum is larger (an elongated rectangle), it is not incised behind, but presents an oval aperture on each side, which, however, is often entirely absent, as in the eagles, &c. Their cœca are very short.

The plumage presents great differences of colour at different periods of life. The females are constantly larger than the males; they lay rarely more than five, the larger species only two eggs, which are almost always white, with red-brown spots. Most of the species feed on live animals, yet some will seize on carrion also.

Falco L. (in part), BECHST. Bill curved, short; upper mandible furnished on each side towards the tip with one or two teeth, lower shorter, truncate and emarginate to receive the tooth of upper. Wings elongate, with first and third quills mostly subequal, the second longest of all. Tail subeven, broad. Tarsi below the heel clothed with the lengthened plumes of tibiæ, reticulate or covered with hexagonal scutes, short, strong.

Sp. *Falco peregrinus* GM., (*Falco communis* BRISS., GM., CUV.), BUFF. *Pl. enl.* 430, 421, 469, NAUM. Taf. 24, 25, SUSEM. *Vög. Eur.* Tab. 8, CUV. *R. Ani., éd. ill., Ois.* Pl. 9, fig. 2; the *peregrine falcon, le faucon, der Taubenfalke;* this species is dispersed over a great part of the old world, and in North America also a species occurs which differs from it little or perhaps not at all (*Falco anatum* BONAP.); WILS. *Amer. Orn.* Pl. 76.—*Falco peregrinoides* TEMM. *Pl. col.* 479, Nubia.

The falcons used in falconry are characterised by a longer tail and shorter toes. *Falco candicans* GM., *Falco groenlandicus* BREHM, BUFF. *Pl. enl.* 446, NAUM. Taf. 21, fig. 1, SUSEM. *Vögel Eur.* Tab. 6 *a*, from the northern parts of the new and the old world, and (the Iceland variety?) *Falco islandus* BRÜNN., NAUM. Taf. 21, fig. 2, SUSEM. Taf. 7. Compare HANCOCK in *Annals of Nat. Hist.* 1838. From both of these SCHLEGEL distinguishes the Norwegian species *Falco gyrfalco* (*Falco lanarius* L. Faun. Suec.?), BUFF. *Hist. nat.* XVI. Pl. 13, which also occurs occasionally in the North of Germany and in Holland; rare in England. (SUNDEVALL refers all the three to one species, *Aorsber.* 1844.) See on these species and on falconry the splendid work *Traité de Fauconnerie, par* H. SCHLEGEL

et A. H. VERSTER DE WULVERHORST, Leiden et Dusseldorf, 1844—1853, Avec 17 pl. color., par SONDERLAND et WOLF, folio.

Sub-gen. *Æsalon* KAUP, *Hypotriorchis* BOIE. (Tarsi longer. Species small.)

Sp. *Falco subbuteo* L., BUFF. *Pl. enl.* 432, NAUM. Taf. 26, SUSEM. *Vög. Eur.* Taf. 10, fig. 1; the *hobby, der Lerchenfalke*, &c.

Tinnunculus VIEILL., *Cerchneis* BOIE. Tarsi somewhat long, covered anteriorly with a double row of scutes. (Toes shorter than in the preceding.)

Sp. *Falco tinnunculus* L., BUFF. *Pl. enl.* 401, 411, NAUM. Taf. 30, the *kestril, la cresserelle;—Falco cenchris* NAUM. Taf. 29, etc.; species which are of a red-brown colour above; the tail-feathers increasing in length from without inwards, with darker transverse bands. Very similar is *Falco punctatus* CUV., TEMM. *Pl. col.* 45, from Madagascar.

Ieracidea GOULD (*Hieracidea*).

Sp. *Falco berigora* VIG. and HORSF.

Hierax VIGORS. Upper mandible bidentate. Wings with second and third quills subequal, longest of all. Tarsi scutellate anteriorly. Toe long, strong.

Sp. *Falco cœrulescens* L., *Falco mayalensis* STRICKL., EDWARDS *Birds*, Tab. 108, VIEILL. *Gal.*, Pl. 18, TEMM. *Pl. col.* 97; Java, and a couple of species from Asia; the smallest diurnal birds of prey.

Harpagus VIGORS. (*Bidens* SPIX, *Diodon* LESS., *Diplodon* NITZSCH.) Bill short, curved, thick, high; upper mandible bidentate. Wings somewhat short, with first quill short, second, third and fourth gradually longer, fifth longest of all. Tail rounded, elongate. Tarsi scutellate anteriorly.

Sp. *Harpagus bidentatus, Falco bidentatus* LATH., TEMM. *Pl. col.* 28, 288;—*Harpagus diodon, Falco diodon* TEMM. *Pl. col.* 198; both from Brasil.

Circus LACEP., BECHST. Bill shorter than head, curved. Upper mandible furnished with a tooth obtuse, obsolete. Cere covered by setaceous, curved plumes. Dense feathers surrounding the lower part of the face with a disc. Wings long, with third and fourth quills longest of all. Tail long. Tarsi elongate, covered anteriorly with transverse scutella.

Sp. *Circus rufus, Falco æruginosus* L., BUFF. *Pl. enl.* 460, 424, NAUM. Taf. 37, 38, fig. 1, SUSEM. *Vög. Eur.* Tab. 36; the *marsh-harrier, moor-buzzard, la harpaye, le busard de marais, die Weihe, Rohr-oder Sumpf-weihe;* Europe, North Africa, some parts of Asia, &c. These species hunt on the

approach of darkness, and build their nest amongst rushes or brushwood on the ground. (The genus *Gypogeranus*, see below p. 552, has affinity with *Circus*.)

Milvus BECHST., CUV. Bill short, somewhat straight at the base, with tip curved. Upper mandible furnished with a rounded, obsolete tooth. Nostrils oval, oblique. Plumes of head and neck narrow, lanceolate. Wings long, with third and fourth quills longest of all. Tail long, frequently emarginate or forked. Tarsi moderate, above plumed in front, below covered with a row of scutes, naked posteriorly, reticulate.

Sp. *Milvus regalis* BRISS., *Falco Milvus* L., BUFF. *Pl. enl.* 422, NAUM. Taf. 31, fig. 1, CUV. *R. Ani., éd. ill., Ois.* Pl. 11, fig. 3; the *kite, le milan, der Milan;* a species dispersed over a great part of Europe; reddish brown, the legs yellow.—*Milvus niger, Falco ater* GM., BUFF. *Pl. enl.* 472, &c.

Elanus SAVIGNY. Tarsi very short, reticulate with scales. Tail very long. (Wings with second quill longest of all.)

Sp. *Milvus melanopterus, Falco melanopterus* DAUD., &c.
CUVIER placed also in this sub-genus *Falco furcatus* L., *Milvus carolinensis* BRISS., BUFF. *Pl. enl.* 72, WILSON *Amer. Ornith.* Pl. 51, fig. 3, with tail very deeply forked, which species forms the type of the sub-genus *Nauclerus* VIGORS. Here also belongs a species from Africa, *Falco Riocouri* VIEILL., TEMM. *Pl. col.* 85.

Ictinia VIEILL., GRAY.

Sp. *Milvus cenchris* VIEILL., *Falco plumbeus* GM., TEMM. *Pl. col.* 180;—*Falco mississippiensis* WILS., *Ictinia ophiophaga* VIEILL., *Gal. des Ois.* Pl. 17, WILS. *Am. Ornith.* Pl. 25, fig. 1.

Pernis CUV. Bill short, curved, with tip hooked, the margin of upper mandible sinuate, without tooth. Nostrils narrow, oblique. Region in front of eyes at the base of bill beset with short, rigid, imbricate plumes. Wings with second and following quills up to the sixth sinuate internally before the extremity, the fourth longest of all. Tail long, subrounded. Tarsi feathered in front above, reticulate below.

Sp. *Pernis apivora* CUV., *Falco apivorus* L., BUFF. *Pl. enl.* 420, NAUM. Taf. 35, 36, SUSEM. *Vög. Eur.* Taf. 35; the *honey-buzzard, la bondrée, der Wespenbussard:* this bird hunts for wasps and bees; the colour presents many individual differences; it is found in the east and south parts of Europe and in Eastern Asia; in Germany it is a bird of passage, which arrives late in the spring. It represents the Cuccoo amongst the falcons. —*Pernis cristata* CUV., *Règne Ani.* Pl. 3, fig. 4, *Falco ptilorhynchus* TEMM.

Pl. col. 44, DESMURS *Pl. peint.* Pl. 13, 14 (*Pernis torquata* and *ruficollis* LESS.); Java, Sumatra. (In the stomach of this species also hymenopterous insects have been found.)

Note.—Here are to be inserted sub-genera *Hyptiopus* HODGS. (*Baza* ejusd. [previously), *Lophotes* LESSON, *Avicida* SWAINS., on which cons. GRAY *Gener. of Birds*, I. 23. Upper mandible with two small teeth before the tip.

Sp. *Pernis lophotes, Falco lophotes* CUV., TEMM. *Pl. col.* 10; the East Indies.

Cymindis CUV. (and *Rosthramus* LESS.!) Bill compressed, arched; upper mandible with tip hooked, produced. Nostrils small, narrow, basal. Wings long, with third and fourth quills longest of all. Tarsi plumed above on the anterior surface. Toes long.

† Tail long, rounded. Tarsi short.

Sp. *Cymindis cayennensis, Falco cayennensis* GM., BUFF. *Pl. enl.* 473, TEMM. *Pl. col.* 204, 270;—*Cymindis uncinatus, Falco uncinatus* ILLIG., *Cymindis cuculoides* SWAINS., TEMM. *Pl. col.* 103, 104, 105.

†† Tail even, moderate. Tarsi elongate, scutellate anteriorly below the plumes.

Sp. *Cymindis hamatus, Falco hamatus* ILLIG., *Rosthramus niger* LESS., TEMM. *Pl. col.* 61, 231, LAFRESN., GUÉR. *Magas. de Zool.* 1834, Pl. 20. (Species all from South America.)

Buteo BECHST. Bill short, curved, with tip hooked, margin of upper mandible sinuate. Nostrils oval, transverse. Wings long, with third and fourth quills subequal, longest of all. Tail moderate, even or subrounded. Tarsi long; toes short.

Archibuteo BREHM. Tarsi hirsutely feathered in front to the base of toes.

Sp. *Buteo lagopus, Falco lagopus* BRÜNNICH (*Ornithologia borealis*, Hafniæ, 1764, 8vo, p. 4), NAUM. Taf. 34, SUSEM. *Vög. Eur.* Taf. 34; from the North of Europe and Siberia; the *rough-legged buzzard;* an occasional visitant in England, visits the Netherlands in the autumn and often remains over the winter.—*Buteo Sancti Johannis, Falco Sancti Johannis* GM., WILS. *Am. Ornith.* II. Tab. 53, fig. 1, 2, 83, (p. 54) fig. 1, *Faun. bor. Am., Birds*, Pl. 28; from North America, often confounded with the preceding species. BONAPARTE refers also to this species *Falco ferrugineus* LICHTENST., GRAY *Gen.* Pl. VI.

Buteo BREHM. Tarsi covered anteriorly with a row of transverse scutella.

Sp. *Buteo vulgaris* BECHST., *Falco buteo* L., BUFF. *Pl. enl.* 519, NAUM. Taf. 32, 33, SUSEM. *Vög. Eur.* Taf. 33; the *common buzzard, la buse commune, der Maüsebussard;* legs and cere yellow, tail with about twelve transverse dark bars, the general colour mostly brown yet with very many individual differences; this falcon feeds on moles, mice, rats, frogs, &c., and is dispersed over a large part of Western Europe. In North America different species of this sub-genus are found.

Astur BECHST. Bill short, curved, compressed; upper mandible with obsolete, rounded tooth. Nostrils placed near the culmen of bill, oval, oblique or horizontal. Wings with first quill short, fourth, or fourth and fifth longest of all. Tail elongate, far surpassing the points of wings, mostly even. Tarsi long, scutellate anteriorly.

Nisus CUV., *Accipiter* BRISS., GRAY. Tarsi slender, plumed below the heel only, with scutes often obsolete or confluent.

Sp. *Astur Nisus, Falco Nisus* L., BUFF. *Pl. enl.* 412, 467, NAUM. Taf. 19, SUSEM. *Vög. Eur.* Taf. 29; the *sparrow-hawk, l'épervier, der Finken-Habicht, der Sperber;* iris and legs yellow; breast and belly white, with red-brown, sinuous, transverse streaks; the adult bird bluish-gray above. A generally dispersed species of Europe, North Africa, and a part of Africa. In Russia SEVEROW has found a bird which, by its longer wings, shorter feet, and some other slight differences, is separated as a distinct species from *Falco Nisus,* under the name of *Astur brevipes. Bullet. de la Soc. imp. des Natur. de Moscou,* 1850, II. pp. 234—239, Pl. I.—III. Some species of this form are found in all parts of the world.

Geranospiza KAUP., *Ischnoscelis* STRICKL.

Astur BECHST. (et recentior.). Tarsi stronger, plumed nearly in the upper third.

Sp. *Astur palumbarius* BECHST., *Falco palumbarius* (and *gentilis*) L., BUFF. *Pl. enl.* 413 (461 and 423 younger), NAUM. Taf. 17, 18, SUSEM. *Vög. Eur.* Taf. 28; the *gos-hawk, l'autour, der Habicht.* Of this form also species are met with in all parts of the world, especially in Australia, where amongst others an entirely white species has been observed, which SAL. MUELLER met also at New Guinea: *Falco novæ Hollandiæ* GM., WHITE *New South Wales,* Pl. 35, p. 250.

Note.—Here are to be inserted some genera of modern writers: *Melierax* GRAY, *Asturina* VIEILL., KAUP, &c., on which cons. GRAY *Gen. of Birds,* I.

Morphnus CUV.

Thrasaëtus GRAY, *Harpyia* CUV.

Sp. *Astur harpyia, Vultur harpyia* L., *Falco destructor* DAUD., CUV. *R. Ani.* Pl. III. fig. 3, TEMM., *Pl. col.* 14, LESS. *Ornith.* Pl. 10, 11, fig. 1; more than three feet in size; bill black, legs yellow, a crest of black feathers at the back of the head, back and wings black, belly and breast white, a narrow black ring round the neck; in South America.

Circaëtus VIEILL. Bill shorter than head, curved; upper mandible with margin sinuate, tip hooked. Nostrils oblique or longitudinal, oval. Wings with second and third quills subequal, longest of all. Tail long, even. Tarsi long, plumed below the heel, elsewhere reticulate with hexagonal scales. Toes reticulate, scutellate above the base of claws, outer toes conjoined by membrane. Claws curved, grooved beneath.

Sp. *Circaëtus gallicus, Falco gallicus* GM., *Aquila brachydactyla* WOLF, BUFF. *Pl. enl.* 413, NAUMANN, Taf. 15, SUSEM. *Vög. Eur.* Taf. 35 *a.*, South of Europe, Egypt, Arabia;—*Circaëtus cinereus* VIEILL., *funereus* RUEPPELL, VIEILL. *Gal.* Pl. 12, RUEPPELL *Faun. Abyss.* Tab. 14;—*Circaëtus holospilus* (*Buteo holospilus* VIGORS), GRAY *Gener.* Pl. VII. These birds are placed by some writers with the genus *Buteo*, with which they have some analogy.

Spilornis GRAY, KAUP. Sp. *Falco bacha* DAUD., *Falco albidus* CUV., TEMM. *Pl. col.* 19.

Herpetotheres VIEILL.

Sp. *Circaëtus cachinnans, Falco cachinnans* L., VIEILL. *Gal.* Pl. 19;—*Circaëtus brachypterus* (*Micrastur* GRAY), TEMM. *Pl. col.* 141, 116.

Gymnogenys LESSON, *Polyboroïdes* (!) SMITH, GRAY.

Poliornis KAUP, GRAY. Tarsi covered anteriorly with a row of larger scales or small scutes. Tail rounded. Wings reaching nearly to the end of tail.

Sp. *Circaëtus liventer, Falco liventer* TEMM. *Pl. col.* 438, Timor;—*Circaëtus poliogenys, Falco poliogenys* TEMM. *Pl. col.* 325; from the eastern parts of Asia, also at Japan.

Aquila BRISS., CUV. Bill shorter than head or moderate, curved (straight at the base, arched downwards toward the tip). Upper mandible with margin sinuate. Nostrils oblique, oblong. Wings with fourth and fifth quills subequal, longest of all. Tail moderate or long, graduated or rounded. Tarsi long, hirsute to the toes. Toes reticulate with scales, scutellate above the base of claws; outer toes connected at the base by membrane.

Sp. *Aquila chrysaëtos* CUV., *Falco fulvus* and *Falco chrysaëtos* L., BUFF. *Pl. enl.* 409, 410, NAUM. Taf. 8, 9, SUSEM. *Vög. Eur.* Taf. 16, 17, CUV. *R. Ani.*,

éd. ill., Ois. Pl. 10, fig. 2; the *golden eagle, l'aigle commun, l'aigle royal, der Stein-Adler;* length to three feet, breadth seven feet; bill bluish-black, cere and toes yellow, feathers brown, at the back of neck ruddy, tail longer than the points of the wings. This species occurs in Europe, North Asia and North America:

Aquila imperialis, Falco imperialis BECHST., *Aquila heliaca* SAVIGNY, TEMM. *Pl. col.* 151, 152, NAUM. Taf. 6, 7, SUSEM. *Vög. Eur.* 44, 45; in this species the points of the wings extend beyond the tail; it is found on wooded mountains of Germany, but chiefly in Hungary and Dalmatia, and also in Egypt.

Sub-gen. *Onychaëtus* KAUP. Outer toe abbreviate; inner equal to middle, with claw long, somewhat straight. Sp. *Aquila malayensis* TEMM. *Pl. col.* 117, Java, Sumatra.

Haliaëtus SAVIGNY. Tarsi plumed below the heel, with the lower part covered in front with transverse scutella, as are the toes also. Toes reticulate at the base alone, the outer not conjoined by membrane. (Other characters almost of the preceding genus.)

Sp. *Haliaëtus ossifragus, Falco ossifragus* L., and *Vultur albicilla* L., BUFF. *Pl. enl.* 112, 415, NAUM. Taf. 12, 13, LESSON *Ornith.* Pl. 8, fig. 2; the *osprey, l'orfraye, le pygargue, der See-Adler;* bill in the young bird black, in the adult light yellow, toes yellow; adult brownish grey, head and neck with a lighter tint, tail white; the young spotted brown; length 2½ feet, breadth from tip to tip of wings 7 feet; in the whole North of Europe, visits our coasts especially in winter, and in hard weather goes deeper inland, feeds on fish, also on small mammals, hares, &c.—*Haliaëtus vocifer, Falco vocifer* DAUD., DESMURS *Pl. peint.* 8, South Africa, &c.

Thalassaëtus KAUP. Nostrils narrow. Tarsi strong, thick, reticulate, scutellate above the toes.

Sp. *Haliaëtus pelagicus, Aquila pelagica* PALL., *Zoogr. Rosso-asiat.* Fasc. 3, *Pl. col.* 489.

Helotarsus SMITH, *Theratopius* LESS.

Sp. *Helotarsus ecaudatus, Falco ecaudatus* VIEILL. (Only a single species is known hitherto, from Africa. Tail very short. Tarsi reticulate, with oval, irregular, protuberant scales. Genus intermediate between *Circaëtus* and *Haliaëtus.*)

Pandion SAVIGNY. Bill shorter than head, curved, with tip produced, hooked, with margin sinuate. Nostrils inclined, nearly transverse. Wings long, produced nearly to the end of tail, with second and third quills longest of all. Tail moderate, subeven. Tarsi reticulate. Outer toe versatile. Claws curved, large, nearly semicircular, rounded below, not grooved.

Sp. *Pandion haliaëtus, Falco haliaëtus* L., BRISS. *Ornith.* I. Pl. 34, BUFF. *Pl. enl.* 414, NAUM. Taf. 16, SUSEM. *Vög. Eur.* Taf. 24; the *bald buzzard,*

le balbusard, der Fluss-Adler. This species feeds on fresh-water fish, and is found in Europe, Arabia, Egypt, &c. Whether the North American Fish-Eagle (*Falco carolinensis* GM., WILS. *Am. Orn.* II., 1. 103, Tab. 37, fig. 1, VIEILL. *Gal.* Pl. II.) be specifically different, requires further investigation. SCHLEGEL unites them both with *Pandion leucocephalus* GOULD, from New Holland, as one species.—*Pandion humilis* J. MUELLER and SCHLEG., *Verhand. over de nat. Gesch. der Nederl. Overzeesche bezittingen, Aves*, Tab. 6; Sumatra, Malacca. This species, as also another from the East Indies, which according to MUELLER occurs chiefly at Borneo, *Falco ichthyaëtus* HORSF., is distinguished from *Pandion haliaëtus* by some characters of structure. Comp. MUELLER and SCHLEGEL loc. cit.

Polyborus VIEILL. (*Caracara* AZARA, CUV.) Bill shorter than head, compressed, curved; upper mandible with margin sinuate or furnished with an obtuse, rounded tooth. Cere large; nostrils placed at the anterior margin of cere near the culmen. Wings long, with third, or third and fourth quills longest of all. Tail long or moderate, rounded, broad. Tarsi long, reticulate, covered anteriorly with scutella in pairs, lower down above the bases of toes with a single row of scutella. Toes covered in front with transverse scutes; claws moderate, moderately curved. Region round the base of bill and eyes somewhat naked, covered with scattered setaceous plumes.

Sp. *Polyborus vulgaris*, VIEILL., *Falco brasiliensis* GM., VIEILL. *Gal.* Pl. 7; very numerous in South America.

Sub-gen. *Ibycter* VIEILL. (and *Milvago* SPIX).

Sp. *Polyborus aquilinus*, *Ibycter leucogaster* VIEILL., *Falco aquilinus* GM., BUFF. *Pl. enl.* 417, &c. All the species from South America, except one from New Holland and other islands of the South Sea; *Polyborus leucurus*, *Falco leucurus* LATH., GM.; *Falco Zeelandiæ* TEMM. *Pl. col.* 192, 224.—These birds form the transition from *Circaëtus* to the following family.

Gypogeranus ILLIG., *Serpentarius* CUV. Bill shorter than head, curved, compressed towards the tip, hooked. Nostrils lateral, oblique, almost vertical, placed at the anterior margin of cere. Orbital region naked; head closely covered with plumes. Tarsi elongate, slender, more than double the length of middle toe, covered in front and behind with a row of transverse scutes. Toes short, the outer conjoined at the base by membrane; hallux small, resting on the point only. Wings elongate, with third, fourth and fifth quills subequal, longest of all. Tail graduated, with two middle feathers very long.

Sp. *Gypogeranus serpentarius* ILLIG., *Falco serpentarius* GM., *Serpentarius reptilivorus* DAUD., GRAY, BUFF. *Pl. enl.* 721, A. VOSMAER *Beschrijv. van*

eenen Afrikaanschen roofvogel, Sagittarius genaamd; Amsterd. 1769 (with a col. fig.), LATH. *Synopsis* I. Pl. II., LESS. *Ornith.* Pl. 3, fig. 2, GUÉRIN *Iconogr., Ois.* Pl. 3, fig. 4; the cere and the naked region round the eyes yellow, back bluish-grey, thighs black, a crest of long, black feathers behind the head; length 3 feet. This South African bird feeds chiefly on snakes, like *Circaëtus gallicus* (see above p. 550) in Europe.

Family LIV. *Vulturinæ.* Bill moderate, with culmen straight at the base, constricted in front of cere, curved towards the tip; upper mandible with margin sinuate, never dentigerous. Tarsi reticulate with scales, sometimes hirsute or semi-hirsute. Middle toe much longer than lateral toes; outer toes conjoined at the base by membrane. Claws slightly curved, obtuse. (In most the head and upper part of neck are naked or beset with scattered plumules. Eyes surrounded by the flattened face, not placed in a depression under exsert plumes.)

Gypaëtus STORR, *Phene* SAVIGNY. Bill moderate, compressed; upper mandible ascending in front of cere, then curved, with tip hooked. Nostrils vertical, oval, beset with recumbent, rigid, dense bristles. Head closely plumed, bearded with rigid setæ under the bill. Feet short, with tarsi hirsute to the toes. Wings long, with first quill somewhat short, second and third subequal, longest of all. Tail cuneate, somewhat long.

Sp. *Gypaëtus barbatus* CUV., *Vultur barbatus* L., *Falco barbatus* GM., and *Vultur barbatus* ejusd., TEMM. *Pl. col.* 431, NAUM. Taf. 4, 5, GUÉR. *Iconogr., Ois.* Pl. 1, fig. 4, LESS. *Ornith.*, Pl. 6, fig. 2. GRAY *Gener.* Pl. 1; *der Lämmergeier, der Geieradler;* this bird lives on lofty mountains, especially of the South of Europe and West of Asia. It feeds chiefly on goats, lambs and chamois, which it kills by casting them down from the precipice; the feet are not very strong, and less adapted for the seizing and retaining of prey. It attains a length of nearly 4 feet, whilst it is 9 or 10 feet from tip to tip of wings. On the Pyrenees and in Sardinia a variety, constantly smaller, is met with (KUESTER *Isis*, 1835, s. 209, SCHLEG. in SUSEM. *Vög. Eur.* s. 19). More interesting appears to be the difference which the African Lämmergeier presents; in which the tarsi are not destitute of feathers below. (*Gypaëtus meridionalis* BLAS. and KEYSERL., RUEPPELL *Syst. Uebers. der Vögel. N. O. Afr.* Taf. 1.)

Gypohierax RUEPPELL, *Racama* GRAY. Bill shorter than head, compressed, with culmen curved towards the tip, which is acute. Nostrils vertical placed in the naked cere. Region at the base of bill and around the eyes naked. Wings with third and fourth quills

subequal, longest of all. Tail moderate, rounded. Tarsi moderate, strong, plumed below the heel, elsewhere reticulate, with scales large, hexagonal.

Sp. Gypohierax angolensis RUEPPELL, *Falco angolensis* GM., GRAY *Gen.* Pl. IV.; white, base of the tail and a large portion of the wings black. This bird, rare and still little known, is a native of the western part of tropical Africa, and has been brought alive to Europe within the last few years.

Vultur L. (in part), ILLIG., TEMM. Bill moderate, thick, higher than broad, hooked at the tip; lower mandible shorter, obtuse at the tip. Nostrils placed in the cere, naked, vertical. Head and upper part of neck naked or covered with down. Wings long, with third and fourth quills subequal, fourth longest of all. Tail moderate, rounded. Tarsi strong, reticulate with small scales.

The vultures live principally on carrion; they diffuse a disgusting smell. The species of this genus all belong to the warm countries of the old world.

Sub-genera. *Gyps* SAV., GRAY, *Otogyps* GRAY and *Ægypius* SAV. (*Vultur* GRAY).

† *Tail with twelve feathers.*

Sp. *Vultur monachus* L., *Vultur cinereus* GM., *Vultur arrianus* TEMM., BUFF. *Pl. enl.* 425, NAUM. Taf. 1, SUSEM. *Vög. Eur.* Taf. 1; Southern Europe, Egypt.

†† *Tail with fourteen feathers.*

Sp. *Vultur fulvus* BRISS., GMEL., *Vultur leucocephalus* MEYER, BUFF. *Pl. enl.* 426, CUV. *R. Ani., éd. ill., Ois.* Pl. 7, fig. 4, NAUM. Taf. 2, SUSEM. Pl. 2, 3, 3 *a*; from the South East of Europe, Asia Minor, &c.

Percnopterus CUV., *Neophron* SAVIGNY. (Species of *Vultur* L.) Bill a little longer than head, slender, with culmen gibbous at the base, with tip hooked. Cere produced beyond half of the bill. Face naked. Nostrils horizontal (parallel to the margin of mandible). Wings with third quill longest of all. Tail moderate, cuneate. Tarsi reticulate.

Sp. *Percnopterus veterum, Vultur percnopterus*, L., BUFF. *Pl. enl.* 427, 429, LESS. *Ornith.* Pl. 6, fig. 1, NAUM. Taf. 3, SUSEM. Taf. 4; white, the flag-feathers black; young bird coloured brown. This bird lives in Africa, Asia and the South of Europe. Since it consumes carrion it is of great benefit in warm countries, and was honoured by the Egyptians; it is often seen figured on their monuments;—*Percnopterus niger* LESS., *Cathartes monachus* TEMM. *Pl. col.* 222; from West and South Africa.

Cathartes ILLIG. Bill moderate, with tip arched, strong. Cere large; nostrils pervious, horizontal, naked, placed in cere. Wings

long, with third and fourth quills subequal, longest of all. Tail moderate, subeven or rounded. Tarsi short, reticulate with small scales. Head and neck naked.

All the species of vultures with perforate nostrils are from the new world. To these belongs *Cathartes fœtens* ILLIG., BUFF. *Pl. enl.* 187 (*Cath. aura* SPIX). It is this very common species of which TSCHUDI relates that black vultures in incredible numbers sit on the walls of the streets and on the roofs of the houses in Peru, in midday heat, and sleep with their head under their wings.—*Vultur aura* L., VIEILL. *Gal.* Pl. 4, WILS. *Am. Orn.* Pl. 75, fig. 1; both in North and South America; the Prince MAXIMILIAN ZU WIED, however, distinguishes specifically *Vultur septentrionalis* from *Vultur aura*.

A couple of species have large fleshy lobes at the base of the bill (the sub-genus *Sarcorhamphus* DUMÉR.). To it belongs a bird very common in the plains of the whole of South America, *Cathartes papa*, *Vultur papa* L., BUFF. *Pl. enl.* 428, LESS. *Ois.* Pl. 5, fig. 1, *Dict. univ. d'Hist. nat.* Pl. 13, GUÉRIN *Iconogr., Ois.*, Pl. 1, fig. 3; the *king of the kites*. Another species, on the contrary, inhabits the lofty mountain-range of the Andes, and has in its manners a striking resemblance to the Lämmergeier. It is the *Condor*, a bird of 14 feet in the flight: *Cathartes gryphus*, *Vultur gryphus* L., HUMBOLDT *Observ. de Zool.* Pl. 8, TEMM. *Pl. col.* 133, 408 (and 494, head of a male bird, natural size), LESS. *Ornith.* Pl. 7, GUÉR. *Icon., Ois.* Pl. 4, fig. 2, *Dict. univ. d'Hist. nat., Ois.* Pl. 1, fig. 1. On the anatomy see HARLAN *Transact. of the American Philos. Soc.* Vol. III. p. 2 (new series), Philadelphia, 1830, p. 466.

CLASS XVII.

MAMMALS (*MAMMALIA*)[1].

THE mammals are vertebrate, warm-blooded animals, breathing by means of lungs; they differ from birds in having a muscular midriff or diaphragm (with ARISTOTELES διάζωμα) between the cavity of the thorax and that of the abdomen, and in having glands

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[1] A chief work for this class is the natural history of BUFFON, in which DAUBENTON has communicated his numerous anatomical observations. The figures that are to be found there will be generally referred to by us. (*Histoire naturelle.* Paris, Imprimerie royale, Tom. II—XIV. 1749—1767, Supplém. Tomes III. 1776, VI. 1782, VII. 1789).

J. C. D. VON SCHREBER *Die Säugthiere in Abbildungen nach der Natur.* Erlangen, 1775—1846, VII. Thle. 4to. (And *Supplementband von* J. A. WAGNER, IV. Thle. 1840—1845.) A work, of which the publication was carried on for 71 years, and which has been continued since 1835 with great diligence and care by WAGNER, and finally is completed. A fifth part of the Supplemental Band (as a distinct work) was commenced by W. in 1853 and finished in 1855 (Leipzig, T. O. WEIGEL).

GEOFFROY ST.-HILAIRE *et* F. CUVIER *Histoire naturelle des Mammifères,* folio, Paris, 1820—1835 (60 Livraisons ou 3 vol.); with coloured lithograph plates. In 1826 a new and less costly edition in 4to was commenced, estimated to consist also of 60 Livr., of which, however, only 22 (132 plates) have been published, and which appears to remain incomplete.

G. R. WATERHOUSE *Natural History of the Mammalia.* With engravings. London. 8vo. Vol. I. 1846, *Marsupiata,* Vol. II. 1848, *Rodentia.* (It is to be regretted for the science that this work, as is almost to be feared, will not be completed.)

C. J. TEMMINCK *Monographies de Mammalogie,* Tome I. Paris, 1827, Tome II. Leiden, 1835—1841. (With many figures, especially of crania.)

F. CUVIER *Des Dents des Mammifères considérés comme caractères zoologiques.* Paris et Strasbourg, 1825, 8vo.

For the anatomy of the Mammals may be consulted: the first part of the *Zoologie* of F. TIEDEMANN (already cited under the birds), Landshut, 1808, 8vo, and the compressed article *Mammalia* of OWEN in TODD'S *Cyclopædia,* III. 1847, pp. 234—245. Beautiful figures of skeletons are to be found in the distinguished work of PANDER and D'ALTON *Vergleichende Osteologie,* Bonn, 1821—1831, in 12 Nos.

Systematic works are: *Synopsis methodica animalium quadrupedum et serpentini generis, auctore* JOANNE RAIO. Londini, 1693, 8vo;—J. C. P. ERXLEBEN *Systema regni animalis. Classis* I. *Mammalia,* 1777, 8vo;—*Prodromus methodi Mammalium, Inaug. Disput. Præside* G. C. STORR, *respondente* J. WOLLFER, Tubingæ, 1780, 4to;—P. BODDAERT *Elenchus Animalium,* Vol. I., *sistens quadrupedia.* Roterodami, 1784, 8vo; C. ILLIGERI *Prodromus systematis Mammalium et Avium.* Berolini, 1811; 8vo;—A. G. DESMAREST *Mammalogie (Encycl. méthod.)* Paris, 1820, 4to;—J. B. FISCHER *Synopsis Mammalium,* Stuttgardiæ, 1829, 8vo. (*Addenda, Emendenda et Index,* ibid. 1830.)

which secrete the milk, with which the mother feeds her young, and in being viviparous. Their skin, moreover, is not covered with feathers, but commonly with hair; only some have horny scales or shields, which cover the back or also the feet and the upper part of the head.

The skeleton of mammals deserves, in the first place, our consideration. The vertebral column is, with the exception of the cetaceous animals, divided into the same regions as in man, viz. the cervical, the dorsal, the lumbar, the sacral and the caudal. In the cetacea, numerous vertebræ (in the porpess four or five and forty) succeed to the dorsal vertebræ, and compose the tail, in which the lumbar region cannot be distinguished from the sacrum. Although the neck in the various species differs greatly in length, still it is found to consist in this class, with two or three exceptions, constantly of seven cervical vertebræ. The three-toed sloth (*Bradypus tridactylus*) has nine cervical vertebræ[1]; in *Manatus australis* there are commonly six. Consequently the length of the neck does not depend upon the number of its vertebræ[2]. In the ungulate animals the length of the neck corresponds to that of the fore-legs[3]. There are generally thirteen dorsal vertebræ present, as in most of the ruminants, and many rodents, in most species of the genus *Felis*, in the dog, the fox, &c.; seldom only are there fewer than twelve (eleven in some bats and in species of *Dasypus;* in one species of this genus, according to CUVIER, there are only ten, which appears to be a solitary exception). Just as rare is it almost that there should be more than fifteen; the horse has

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[1] This remarkable exception was first noticed by WIEDEMANN, and by ROUSSEAU, prosector of the Museum of the Garden of plants at Paris; see *Ann. du Mus.* v. 1804, p. 201. *Bradypus torquatus* has 8 cervical vertebræ; *Bradypus didactylus* has the usual number (7). Although on the two lowest cervical vertebræ in *Bradypus tridactylus* traces of ribs are found (see TH. BELL *Transact. of the Zool. Soc.* I. p. 113), yet these vertebræ are not on this account to be considered as dorsal. (The transverse processes of all the cervical vertebræ in the mammals and also in man have a rudimentary rib on the anterior root.)

[2] The neck in man forms about one-seventh of the length of the whole verbetral column; in the giraffe three-sevenths.

[3] The elephant forms a remarkable exception to this rule, and the proboscis, which performs the office of a hand (ARISTOTELES *Historia anim.* Lib. II. cap. 1), compensates the absence of a long neck, which would be ill able to support the heavy mass of the head. Comp. CICERO *De natura Deor.* Lib. II. cap. 50.

eighteen, the rhinoceroses have nineteen or twenty, the elephants from nineteen to one and twenty, and the three-fingered sloths twenty-three or twenty-four, which number is the largest that has been observed in this class. The most common number of the lumbar vertebræ appears to be six or seven; in a few only (the genus *Stenops*) eight or nine; in many there are five, as in man; only very rarely are there less than four; in the two-toed anteater, the two-toed sloth, and the ornithorhynchus, there are only two. The number of vertebræ of the sacrum is commonly four, but varies from one to nine. In no division of the vertebral column is the number of the component vertebræ subject to greater difference than in the tail, where it varies from four to forty-six. This last number occurs in the long-tailed *Manis*, in which the tail has nearly three times the length of the rest of the vertebral column.

The first vertebra has in mammals constantly two articular cavities, for the reception of the two condyles which are found at the sides of the occipital foramen of the skull. This articulation of the skull serves for depressing and raising the head; for rotating it to the right side or the left, there is the articulation of the ring-like first cervical vertebra with the vertical process on the body of the second (*epistropheus*, *dens epistrophei*), which has a smooth articular surface on its anterior side. In this motion the first vertebra with the head rolls round the second. In the true whales this tooth-like process is wanting. With them the short neck is immoveable, like the anterior part of the vertebral column in fishes. In many of them also the cervical vertebræ are anchylosed; in the dolphins the first two only have coalesced, and the arches of the five remaining cervical vertebræ are as thin as paper. In the ungulate animals, the carnivora, nay in almost all mammals, with the exception of man and the *quadrumana*, the first two cervical vertebræ are much larger than the rest; the first has broad, flat transverse processes, which sometimes surpass the breadth of the skull; the second vertebra is long, and its spinous process forms a lengthened ridge-like plate, which extends over the arch of the first cervical vertebra. In many mammals the spinous processes of the cervical vertebræ are conspicuously developed on the second and seventh alone. The spinous processes, on the contrary, of the dorsal vertebræ are commonly long, especially in the ungulate animals. To these processes the cervical ligament (*ligamentum nuchæ*

s. *cervicale*) is attached, which in man is represented by merely a condensed band of the *fascia nuchalis*. This ligament is in the horse and the ruminants powerfully developed, and arises even from the spinous processes of the lumbar vertebræ. In the carnivorous animals it arises from the posterior cervical vertebræ, and the first dorsal alone. Forwards it is attached to the spinous process of the second cervical vertebra, and often to the crest also of the occipital bone, above the large occipital foramen[1]. The sacrum in man retreats backwards, and makes an angle with the lumbar vertebræ; in the rest of the mammals, on the contrary, it lies nearly in the same plane with the lumbar vertebræ, and is also narrower than in the human skeleton. In the ox (and in most of the rest of the ruminants) the spinous processes of the sacral vertebræ coalesce to form a ridge, by which amongst other characters the sacrum of the ox is markedly distinguished from that of the horse.

The last vertebræ of the tail cease to have an arch; their form is that of the phalanges of the fingers or of a double cone, of which the points are turned towards each other, as in an hour-glass. In many, especially in long-tailed mammals (as *Halmaturus*, *Dasypus*, *Manis*, *Myrmecophaga*, also in the *Cetacea*), most of the caudal vertebræ are furnished with inferior spinous processes, which present the form of a V, and arise between two bodies of vertebræ. In the beaver (*Castor*), in which the transverse processes in the tail are very large, those lower spinous processes exceed the upper in size.

Each rib usually is connected in mammals by its head, with an articular cavity formed by the bodies of two vertebræ[2], and in addition backward by a tubercle with the transverse process of the posterior of those two vertebræ. In the monotremes, the ribs are connected with the body of the vertebræ alone. In the cetaceous

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[1] In the elephant there is at this part a cavity with many projecting bony plates, by which this ligament is attached more firmly; compare P. CAMPER *Description anat. d'un Elephant*, *Œuvres*, II. p. 177, Pl. XX. fig. 1, A, B, C, D; Pl. XXIV. B, G. 20, 3, H. 5.

[2] According to the observation of RETZIUS, these *foveæ costales* belong originally to the arches of the vertebræ, as may be seen in skeletons of children and young mammals, where the bodies of the vertebræ are still separated from the arches by intervening *synchondroses*.

animals, on the contrary, the posterior, or sometimes all the ribs are attached to the transverse processes alone of the dorsal vertebræ. The parts of the ribs which are united to the sternum remain in most of the mammals cartilaginous during the whole life; in some only are these pieces, as in birds (see above, p. 330) early ossified, as in *Bradypus*, *Dasypus*, *Myrmecophaga*, the *Cetacea*, the *Monotremata*. The anterior ribs always extend as far as the sternum, and are thus true ribs, in which respect again the mammals differ from the birds (see above, p. 330). In the mammals the number of true ribs (of which there are mostly seven, eight or nine) commonly exceeds that of the false, that is, of those which are not connected with the sternum.

The sternum in mammals consists mostly of many bony pieces lying behind each other in a row; their form sometimes corresponds with that of the caudal vertebræ, but also is often flat. In most mammals this bone is narrow and lengthened, in the *cetacea* it is broad. A projecting ridge, as in the sternum of birds, occurs only in some burrowing mammals (as in the mole) and in the bats as exceptions.

The anterior limbs are never absent in mammals. They are not always provided with a clavicle and by it connected with the sternum. The *cetacea*, namely, the *ungulata* and some of the *edentata*, have no clavicle. An imperfect clavicle, that does not extend from the top of the scapula to the sternum, is present in some rodents and in the greater number of carnivorous animals, amongst which it appears to be wanting in some few only. The insectivorous mammals, many rodents, all quadrumanous animals and bats, have constantly a perfect clavicle. Usually this bone is long and then not unlike a rib; in the mole it is very short and more thick than long, and provided in front with a process; it has a large articular surface for the humerus, and is on the contrary united to the top (*acromion*) of the shoulder by ligament only. In the genus *Bradypus* the clavicle is not united to the acromion but to the coracoïd process of the scapula. The clavicle of mammals is the *os furculare* of birds (see above, p. 330). A second or coracoïd clavicle is found in the monotremes only (the *Ornithorhynchus* and the *Echidna*).

The scapula is always present. It is a flat, triangular or elongated bone, of which the inner surface, which lies upon the ribs, is

somewhat concave, whilst the outer surface, on the contrary, is usually more or less convex. A projecting crest, named *spine* (*spina scapulæ*), generally divides this outer surface into two parts, and extends upwards over the articular surface of the scapula. In the cetaceous animals the spine lies close to the anterior margin of the scapula, so that the anterior cavity (*fossa supraspinata*) is particularly small. In the bats the scapula has some resemblance to that of birds in its narrow and lengthened form.

The upper-arm bone or *humerus* in man is nearly straight. In the carnivorous animals, on the contrary, it is much bent, and its articular head lies out of the axis. It is short in the ruminants and the horse, where the extent of the forehand is great. Very short is it especially in the cetaceans, long, on the other hand, in the quadrumanous mammals and the sloths.

The humerus in many quadrumanous animals, in the genus *Felis*, *Mustela*, in the squirrels, perhaps in all the edentates, with the exception of *Bradypus tridactylus*[1], and in some other mammals, is perforated above the elbow or provided with an oblique canal. Through this canal or this aperture (*foramen supracondyloïdeum*) there runs by no means, as was formerly asserted, the tendon of the bicipital muscle, but the median nerve of the arm and the brachial artery or the ulnar artery, and often also the ulnar vein[2]. This canal or passage is absent in all cetaceous and ungulate animals. It must not be confounded with another aperture at the inferior extremity of the humerus between the two condyles which is sometimes observed even in man, where the bone at this part is a thin lamina. This aperture is particularly large in the daman and in some rodents.

With the inferior extremity of the humerus the two succeeding bones of the fore-arm are connected by hinge-articulation. The ulna is the longest of the two in man; it lies on the inside of the fore-arm and backwards. Its upper extremity has a deep articular surface (*cavitas sigmoïdea*), and terminates behind in a hook

[1] See A. Brants *Diss. zool. inaug. de Tardigradis.* L. B. 1828, 4to, pp. 42, 43.

[2] Thus it was observed first in the lion by Wolff, and afterwards in the apes by Tiedemann; see the paper of the last named in Meckel's *Archiv für die Physiol.* IV. 1818, s. 544—549. Comp. also V. Baer *ibid.* V. s. 312—314, and Otto *Commentatiuncula de variorib. quibusd. scelcti humani cum animalium scelcto analogiis.* Vratislaviæ, 1839, 4to, pp. 25—27.

(*olecranon*), which is received in the posterior cavity of the inferior extremity of the humerus. The radius is shorter, connected more with the carpus or root of the hand, and can roll round the ulna, so that either the back or the palm of the hand can be turned upwards (*pronatio et supinatio*). From this perfection most of the mammals recede, especially such as make use of their limbs for standing and running only, and not for seizing also. In some the two bones of the fore-arm have even coalesced; in others they remain distinct indeed, but still their relative motion is little or none. The cetaceans have the bones of the fore-arm short, flat, and immoveably connected. In most of the ungulates the two bones of the fore-arm have coalesced downwards. In the horse the ulna is very imperfect and consists only of the olecranon process and a thin bony stile, which unites with the radius and does not extend to the carpus. A rotation of the hand does not occur in ungulate animals, but the dorsal surface is constantly turned upwards (*manus prona*). In the carnivores and rodents radius and ulna remain indeed distinct, but in many the rotation is nevertheless very imperfect. A greater relative mobility of the two bones of the fore-arm occurs in the quadrumanous mammals, which in this, as in the rest of their structure, make an approach to man. In the wing-handed mammals (the bats) the ulna is sometimes entirely absent or is merely a thin spine-like bone, that is situated under the radius[1].

The root of the hand (*carpus*) consists of various small bones (from 5 to 11), that of man of eight, arranged in two rows; the bones of the second row in most ruminants are only two.—The pisiform bone forms in the apes, and especially in the carnivores, a species of heel at the back part of the carpus. In the mole a sickle-shaped little bone, which lies at the inner margin of the hand and extends from the radius to the thumb, deserves special notice.

The fore-hand (*metacarpus*) consists commonly of five small, elongated, cylindrical bones placed side by side. Sometimes there are fewer, and on the whole their number corresponds to that of the fingers. In the ruminants there are originally (in the *embryo*)

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[1] The name of *additamentum ulnæ*, which ALBINUS with so much reason gave to the radius in man, thus has no propriety in Zootomy. Rather is the radius the chief bone of the fore-arm in animals.

two metacarpal bones, but they quickly coalesce to form a single bone (*cannon-bone*). In the horse on each side of the metacarpal bone, which articulates with the single finger, there is a little bony stile which descends from the carpus, but does not extend as far as the finger; these two lateral bony stiles (*splint-bones*) are, according to CUVIER, imperfect fingers, whilst MECKEL regards them as metacarpal bones. The stags also have similar bones; in sheep and oxen a single bone only of the kind is seen on the outside. In the pachydermatous mammals (with the exception of the fossil genus *Anoplotherium*, which has only two) there are at least three bones in the metacarpus; the elephant has five such.

The number of fingers varies from one to five. Of the five (the largest and also the normal number) the third or middle finger is the most constant and commonly also the longest; this is the only finger in the horse. First of all the thumb appears to be absent; in many the fifth (the little) finger also disappears, and after these the fourth finger. In the ruminants two fingers (the second and the middle finger) are constantly present, and in these two other imperfect fingers are added, which, however, are absent in the camel. For other particulars respecting the number of fingers we refer to the Systematic Arrangement, where it will be found recorded amongst the characters of the genera. Perfect fingers have three joints (*phalanges*), except the thumb which has only two. In the whales and dolphins the number of joints of the fingers is larger, especially of the second finger[1]. The last joint of the fingers in the ungulate animals is flat beneath; its anterior margin has the form of a semicircle, and the upper surface descends obliquely from behind forward. In the feline genus the last joint of the fingers has a sigmoïd form; in front it is excavated like a cap, and in the middle of this cavity there rises a compressed conical point. To this cone the claw is adapted, of which the posterior margin is received in the cap and thus firmly fixed. In walking this joint is turned directly upwards, and thus the point of the claw does not touch the ground. At some distance from the inferior extremity of this joint

[1] This is a conformity to reptiles, especially to the fossil genera *Ichthyosaurus* and *Plesiosaurus*. In the genus *Bradypus* the first joint of the finger is very short and soon coalesces with the ossicle of the carpus; see CUVIER *Ann. du Mus.* v. pp. 195, 196.

is found the articulation for the preceding second joint. This second joint has almost the form of a triangular prism, is flat below and excised on the outer side, so that the last joint of the finger when at rest lies in it[1]. Whenever the flexor muscles on the inferior surface of the foot, attached by their tendons to the last joint of the finger, move that joint, the erect claw is drawn forward and downward. When at rest the last joint is supported by two elastic ligaments, which at the back of the hand proceed from the first and second phalanges to the upper margin of the last.

Only in man and in most of the quadrumanous mammals can the thumb be moved separately and placed at a distance from and opposite to the other fingers; but even in the apes the hand is imperfect, for the thumb is shorter. In some the thumb is even wanting, or there is only a small ossicle on the inside by which it is represented[2].

The hind limbs are connected with the trunk more firmly than the anterior. Here in place of the scapulæ are the *ossa innominata*, which are attached immoveably to the sacrum. The three bones which make up the *os innominatum* (the *ilium*, *ischium* and *pubis*) are present in the embryo, and also in young animals as distinct bones. The pubic bones are united with each other below; yet in some, as the mole and many bats, they remain separate. In different mammals the ischia also become united with each other and with the pubic bones. In the marsupiate and monotrematous animals a triangular, flat, moveable bone is attached to the anterior margin of the pubic symphysis on each side, and has its point directed forward. In the cetaceous animals traces alone of innominate bones are found, which are remote from the vertebral column, and are connected with the rest of the skeleton by muscles only; the other bones of the posterior extremities are wanting.

A deep articular cup at the outside of the innominate bone receives the head of the thigh-bone. This bone in most mammals

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[1] This excavation is erroneously stated by CUVIER to be on the *inside* of the second joint. *Leç. d'Anat. comp.* I. pp. 311, 312, and ed. 2, I. p. 434.

[2] Compare on the fingers in mammals CUVIER *Leç. d'Anat. comp.* I. 309—314, *éd. sec.* I. 432—437; MECKEL *Syst. der vergl. Anat.* II. 2, s. 408—421; DUMÉRIL *Ueber die verschiedenen Formen der äussersten Phalangen bei den Säugethieren* in REIL'S *Archiv*, VII. 1807, s. 301—315, with figures (translated from the *Magas. encycl., Année* VI. Tome I. No. 3).

is relatively shorter than in man, where it is the longest bone of the skeleton. The head of the thigh-bone is seated upon a short neck which leaves the bone at a right angle; from this part also the external or great trochanter ascends above the head of the thigh-bone. This bone is remarkably short in the seals (*Phocæ*), where the shaft almost disappears and the two articular extremities form nearly the whole mass. Whilst in man the axis of the thigh-bone in the erect position deviates little from that of the vertebral column, the thigh-bones even of the apes are bent more forward and form an obtuse angle with the pelvis; hence these animals always stand with the knees bent. In the carnivorous animals the thigh-bone makes nearly a right angle with the pelvis. In other mammals, as in the horse and the ruminants, the angle becomes even acute.

With the thigh-bone (*femur*) two other bones of the leg are connected below, the *tibia* and the *fibula*. The knee-joint is strengthened by many ligaments, by the capsular ligament, by the crucial ligaments, the lateral ligaments and the fibrous expansions of the muscles. At its anterior surface is situated the *patella*, which appears to be wanting in different marsupial animals only, is small in the carnivores, broad in the horse and the pachyderms. It is a round, flat, bony disc, which is attached by a ligament arising from its inferior extremity to the projecting anterior surface of the tibia. This ligament is of a tendinous nature and arises from the tendinous tissue of the extensor muscles[1]. The *tibia* corresponds to the radius of the fore-arm, and is situated forward; the *fibula* corresponds to the *ulna*, and is situated backward and outward. The tibia, however, can rotate round the fibula in some marsupiates only, like the radius round the ulna in man and many mammals. In various mammals the tibia and fibula have coalesced, mostly at the lower part. In the horse the fibula is a long stile, which becomes thin downwards and extends from the upper extremity of the tibia to about one half of it only. In the ruminants, on the contrary, the inferior extremity alone of the fibula is present. The tibia terminates below with a smooth articular surface before the first tarsal bone, and has on the inside a process which extends downwards (the inner ankle, *malleolus internus*). The fibula forms with its

[1] Hence the *patella* is a large sesamoïd bone, as BICHÂT and, before him, BERTIN had justly observed.

lower extremity the outer ankle (*malleolus externus*). The first tarsal bone (*talus* s. *astragalus*) is connected by a hinge-joint with the tibia and is placed between the inner and outer ankles. Below, the astragalus is connected with the heel-bone (*calcaneus*), to the projecting posterior extremity of which the tendon of Achilles is affixed. These two are the principal bones of the root of the foot (*tarsus*), besides which in the human skeleton there are five other bones, so that the tarsus consists of seven bones in all, whilst in the other mammals the number of bones in this part of the foot varies from four to nine. In the pachyderms, the carnivorous and the quadrumanous animals, there are on the whole seven bones in the root of the foot as in man. On the other hand, the tarsal bones are more numerous in the edentate mammals and in many rodents. In the horse there are two cuneiform bones instead of three; the other bones are the same as in man, and the entire number is thus six. So also is it in the camel, but the rest of the ruminants have only five tarsal bones, since in them the navicular bone has coalesced with the cubiform bone; and the giraffe has only four, for with a similar coalescence of these two bones, only one cuneiform bone is present. In *Otolicnus* and *Tarsius*, long-footed Lemurids, the navicular bone is very long and lies by the side of the heel-bone, also lengthened, in the same manner as in the fore-arm the radius lies by the side of the ulna. Two such long tarsal bones, placed side by side, occur also amongst the reptiles in the frogs.

The fore-foot (*metatarsus*) usually counts as many bones as there are toes present. The metatarsus in the ruminant and solidungulate animals is conformable to the metacarpus (comp. above, p. 562). In the genus *Dipus* amongst the rodents the three middle metatarsal bones coalesce to form a single bone, which terminates below in three processes, to which the three large toes are connected, and which thus resembles the principal bone of the root of the foot in birds (see above, p. 332).

The digits of the foot in the ruminants, the solidungulates, and commonly also in the pachyderms, correspond in number and form to those of the hand. Such also is the case in most of the carnivorous animals; although in the genus *Felis* and *Canis* the thumb (hallux) of the hind-foot is not developed, of which a trace only is observed in the fore-foot. In the monkeys the thumb is shorter, but the other digits are longer than in the human foot.

The cranial bones are, as in man, connected by suture. The names of the sutures are borrowed from human anatomy. The two parietal bones coalesce in some carnivorous animals, in the bats, in the horse, in the ruminants and rodents, to form a single bone, so that in these there is no sagittal suture. On the other hand, the frontal bone in most mammals is formed of two bones that meet in the mid plane. The number of separate cranial bones is in most mammals less than in reptiles and fishes. As in the rest of the vertebrate animals, four cranial vertebræ may be distinguished. The first or posterior vertebra is formed by the occipital bone. The basilar portion of the occipital bone (the *basioccipital* OWEN) is the body or *centrum* (OWEN) of this posterior vertebra; the articular portions (*exoccipitals*) are the neural arches (*neurapophyses*), and the occipital part (*supra-occipital* OWEN) or *neural spine* is the covering lamina by which the ring is closed above and which often develops a crest. These four parts coalesce in many mammals more slowly than in man to form a single bone. The occipital bone in this class differs from that in the class of birds in there being two articular condyles for connexion with the first cervical vertebra, which lie at the sides of the occipital foramen; in the birds, on the contrary, and in the *Repitilia haplopnoa*, this bone has a single articular tubercle which lies in the middle under the occipital foramen. The occipital foramen is usually, with the exception of man and the monkeys, situated more at the posterior extremity than on the inferior surface, whence the cranium lies more in the same direction with the cervical vertebræ. In most mammals there is seen on the occipital bone a pyramidal process which is often confounded with the *processus mastoïdeus;* it is the descending part of the coalesced par-occipital; and serves, amongst other uses, for the attachment of the *digastric muscle* which depresses the lower jaw; it is very long in the hog and the kangaroo, also (though in a less degree) in the horse and the ruminants[1].

The second cranial vertebra has for its centrum the posterior part of the body of the sphenoïd (*basisphenoïd* OWEN), for its

[1] *Processus jugularis* or *paramastoïdeus*, see HALLMAN *Die vergleichende Osteologie des Schläfenbeins*, s. 7, 8; DUVERNOY names this part *apophysis pyroïdea*. [It is the parapophysis of the occipital vertebra—it is a distinct bone in fishes, but in the rest of the vertebrates is only a process from the ex-occipital, ifi man the *rectus lateralis* muscle is attached to it.—OWEN *Homol.* p. 30.]

neural arches the great alæ of the sphenoïd (*alisphenoïds* Owen), and for its neural spine the parietal or the two parietals. The separation of the sphenoïd bone into two parts is seen in the human embryo (see Pl. XVI. fig. 3), and it persists in most mammals, and even in many monkeys, for the whole life. The posterior part consists of the body of the sphenoïd as far as the anterior clinoïd processes and the greater alæ; the anterior part consists of the anterior clinoïd processes and the *rostrum* (*presphenoïd* Owen) with the lesser alæ (*orbitosphenoïds* Owen). The third vertebra consists of this anterior part of the sphenoïd as its centrum and neural arches, whilst the frontal bone, single or in two lateral halves, is its neural spine. We may remark that the posterior wings of the sphenoïd are with propriety termed the great wings (*alæ magnæ*) in the human cranium, but in many mammals, as the ruminants and pachyderms, they are smaller than the anterior. The fourth cranial vertebra has for its centrum the vomer, for its neural arches the middle portion of the ethmoïd (corresponding to the prefrontals of fishes, which in the superior classes are compressed and coalescent), and for its neural spine the nasal bones.

Between the occipital bone and the second cranial vertebra the temporal bone is placed; it is composed of five parts originally distinct, the petrous bone (*petrosal* Owen[1]), the *mastoïd* bone, the squamous portion (*squamosal* Owen), that part which belongs to the tympanum (the *tympanic* bone) and the styloïd process (*stylo-hyal*).

The internal surface of the cranium presents a cavity which, as in birds, is entirely occupied by the brain, and is thus the cast of its surface. The upper walls, formed by the frontal bone and the parietal bones, are pretty smooth, with the exception of the impressions of the convolutions of the brain and the more conspicuous grooves caused by the vessels and the longitudinal sinus. The

[1] [The petrosal is the interpolated auditory capsule and belongs to the splanchnic skeleton, it coalesces very early with the mastoïd, the parapophysis of the parietal vertebra; the squamosal is part of the diverging appendage of the inverted arch of the nasal vertebra; this last is much expanded and affords in mammals an articular surface for the lower jaw (the frontal hæmapophysis), which in the other classes is articulated with the pleurapophysis of its own vertebra, the tympanic; the styloïd process (*stylo-hyal* Owen) is the pleurapophysis of the parietal vertebra. See Owen *The Archetype and Homologies*, &c. pp. 25—45.]

basal surface, on the contrary, is very uneven, and in man may be divided into three regions. The posterior cavity is occupied by the cerebellum and is bounded forward by the sides of the petrous portion of the temporal bone. The middle cavity extends from hence to the lesser alæ of the sphenoïd; the anterior region is situated on the ethmoïd and above the orbits, and is depressed in the middle; from this depression there arises a process named *crista galli*. These three regions do not lie in the same plane in man; the posterior is the lowest; in mammals they lie more at the same height and are less obviously distinct from each other. In most carnivores, in the horse and some other mammals, there is a bony *tentorium cerebelli*. In many mammals there is above the internal auditory passage (*porus acusticus internus*) a deep blind cavity in which an appendage of the cerebellum (*flocculus*) is received.

There are many outlets in the cranium, especially in the sphenoïd and temporal bones. Most of them transmit blood-vessels and nerves; a few only are the remains of an imperfect ossification. The names of these outlets, as far as they are borrowed from human anatomy, are not very applicable. Also some of the outlets, which in man are distinct, coalesce in animals; thus in the rodents and in the *hippopotamus* there is no canal for the carotid artery (*canalis caroticus*), but the artery runs through the *foramen lacerum anterius*[1].

The second part of the osseous head consists of the bones of the face, amongst which the ethmoïd is included, which also of right belongs to the cranial bones[2]. The vomer is a triangular or quadrangular, elongated bony plate which is placed in front of the rostrum of the sphenoïd and above the palate. The ethmoïd is more largely developed in this than in the other classes of vertebrates, and here alone deserves the name which it has received in human anatomy from its perforated upper surface (the cribriform plate). It is larger when the orbits lie further apart, as in many

[1] CUVIER *Leçons d'Anat. comp.* II. p. 53.

[2] [The interpolated olfactory capsule is the upper turbinate bone and cells of the ethmoïd of its side. The perpendicular lamina and cribriform plate are the coalesced neural arches of the rhinencephalic vertebra, as already stated. OWEN *Homol.* pp. 132, 135.]

mammals, considerably smaller than in man when the eyes are near together, as in the monkeys. The smooth lateral plate, which in man and the monkeys contributes to form the inner wall of the orbit (*lamina papyracea*), is wanting in almost all the rest of the mammals. The nasal bones are large in the carnivores, in the horse, the swine, and especially in the rhinoceros and the rodents. In the rhinoceros they support the horn by which this genus of animals is distinguished; in the two-horned species the posterior horn is set upon the frontal bone. The nasal bones are very narrow in the quadrumanous mammals and unite in many species to form a single bone; this, however, is often the case in other mammals where they are larger. The inferior turbinate bones (*conchæ inferiores, ossa turbinata inferiora*) seem to be present in all mammals[1]. In the ruminants they appear as two laminæ proceeding from a horizontal basal piece, of which one is rolled upwards, the other downwards, and which are perforated by many apertures. In the carnivores (as may be seen particularly in *Phoca, Lutra*, &c.), as well as in many rodents (*Lepus, Sciurus, Castor*, &c.) these turbinate bones consist of numerous hollow tubes which divide into fine branches[2]. The lachrymal bones lie on the outer margin of the nasal process of the superior maxillary bone. They are usually more powerfully developed than in man, and contribute more to form the inner wall of the orbit, where they occupy the place of the ethmoïd. In the ruminants and in some edentates (*Dasypus, Myrmecophaga*) they are much developed on the surface of the face, since the nasal process of the superior maxillary bones does not mount to the orbit; this facial portion has in many ruminants (as in the stags) a deep groove in which sebaceous glands are lodged. The upper jaw is formed principally by the two superior maxillary bones and the two intermaxillaries. These intermaxillary bones differ from the single intermaxillary of birds (see above, p. 334) by the absence of

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[1] That the whales form no exception to this, as MECKEL supposed (*System der vergl. Anat.* II. 2, s. 553), has been manifested by later investigations; in the dolphins two small ossicles are found at the anterior margin of the nasal apertures behind the intermaxillary bone (STANNIUS *Lehrb. der vergl. Anat.* s. 364); in *Balænæ* also ESCHRICHT has found parts corresponding to the *conchæ*; *Untersuchungen ueber die nordischen Wallthiere*, Leipzig, 1849, s. 125.

[2] Comp. HARWOOD *System of Comp. Anat. and Physiol.* Cambridge, 1796, 4to. pp. 20—24.

a nasal process dividing the external nasal aperture into two lateral openings; the *spina nasalis* is a vestige of this. By their lowest portions, which form the anterior margin of the palate, the two intermaxillaries join each other; to this many of the *Chiroptera* present an exception, where instead of the junction a mere space is left. The anterior margin of the intermaxillary bones is very thin, when the incisor teeth are wanting at this part, as in *Lemur;* on the other hand, the intermaxillaries are massive and strong in the rodents and the elephant. In many species of mammals these bones coalesce in old individuals, especially at the anterior surface with the superior maxillary bones; in the human fœtus they are present as distinct ossific points until the fourth month only, whilst after birth there is but a trace remaining in the palate of their original distinctness. To these bones belongs the anterior palatine foramen (or *foramen incisivum*), which in the carnivorous, the ruminating and the solidungulate animals is double. The superior maxillary bones are more elongated than in man and have a broader nasal process. In the ant-eaters, the scaled quadrupeds (*Manis*) and the true cetaceans these bones approximate to the extraordinary length which we formerly remarked in the crocodiles. The malar bones run from the superior maxillary bones to the zygomatic process of the temporal bone; in the sloth (*Bradypus*) these bones do not meet the last-named, and are moreover distinguished by a long, flat process descending on the outside of the lower jaw and terminating below in a point. In the other mammals, on the contrary, the malar bone is usually connected with both bones; in the hippopotamus, the solidungulate, ruminant and quadrumanous animals it is also connected to the frontal bone by an ascending process; but in the monkeys and in man alone is it also united with the great ala of the sphenoïd and forms with it a wall by which the cavity of the orbit is separated from the temporal fossa, so that a fissure only is left (*fissura spheno-maxillaris* s. *orbitalis inferior*), which consequently does not exist in other mammals[1]. The malar bones in *Manis* and some other insectivorous mammals (*Sorex*, *Centetes*) appear to be absent, and although in the Monotremes the zygomatic arch is perfect, yet OWEN is of opinion, that here it is formed exclusively by

[1] HALLER was thus justified in saying "*Homini major quam ulli Bestiarum orbitæ pars ossea est*" (*Elem. Physiol.* v. p. 343), which BLUMENBACH has misconceived, as though HALLER meant that the orbit in man is comparatively the largest. *Handb. der vergl. Anat.* 1824, s. 32.

the zygomatic process of the temporal bone which is united to the superior maxillary. The palate-bones, which are placed between the superior maxillary bones and the pterygoïd processes of the sphenoïd, have in most mammals a longer horizontal piece, by which the posterior part of the hard palate is formed. That this is imperfectly ossified in the marsupial animals and that thus the bony palate in their heads presents larger or smaller apertures, is one of the osteological characters by which OWEN distinguishes this division of mammals. The pterygoïd bones (*pterygoïde interne* of reptiles CUV., the outer plate of the pterygoïd process of the sphenoïd in man) continue long distinct from the sphenoïd, and in some mammals permanently so[1].

The lower jaw differs by two characters from that of the other vertebrate animals; first by its condyle being received by an articular cavity of the temporal bone; next, by its articular portion

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[1] [Having given the formation of the bodies and neural arches of the cranial vertebræ from OWEN's great work, we subjoin that of the inverted hæmal arches in the mammals:

In the occipital vertebra: the hæmal arch is represented in many mammals by the pleura-pophysial element only, the scapula; in many there is a hæmapophysis, the coracoïd, which coalesces with the pleurapophysis, and which completes the arch in the monotremes alone by joining the episternal. In many mammals again the arch is completed by bones which appear to be hæmapophyses of the atlas, the clavicles. The diverging appendage of the occipital inverted arch is the anterior limb.

In the parietal vertebra: the arch consists of pleurapophysis, the styloïd, united to hæmapophysis, the lesser cornu of hyoïd, by ligament and hæmal spine, the body of the hyoïd. The diverging appendage is the posterior cornu of the hyoïd, the thyrohyal.

In the frontal vertebra: the pleurapophysis is the tympanic bone, the hæmapophysis the lower jaw or mandible, the hæmal spine the symphysis. There is no diverging appendage of this vertebra in any vertebrate class above that of fishes, in which it is formed by the opercular bones. Note that in this inverted arch the pleurapophysis is separated from its hæmapophysis by the intrusion of the diverging appendage of the next vertebra, which thus in mammals receives the condyle of the lower jaw, assuming here the office performed by the tympanic in the other vertebrate classes.

In the nasal vertebra the pleurapophysis is the palate-bone, the hæmapophysis the superior maxillary, the hæmal spine the two præmaxillaries. Here the diverging appendage consists of a bone which connects this vertebra with the descending process of the sphenoïd, and with which process it usually coalesces, forming the outer lamina of the pterygoïd process: and further of two other elements, succeeding each other, of which the proximal piece is the malar, the distal the squamosal which expands as it diverges. OWEN *Homol.* p. 132.

Hence, exclusive of the olfactory capsule and the muco-dermal bones, the lachrymal and turbinate, the bones of the face in mammals all belong to the inverted arches of the nasal and frontal vertebræ.]

being never separate from its dental portion as a distinct bony piece. The bone consists of two lateral parts, which meet in front at the chin, but only in some mammals, as in man, entirely coalesce.

Since the face includes the organs of sense, and by means of the jaws is connected with the lower functions and necessities of life, whilst the cranium on the contrary contains the brain, the noblest part of the central nervous system, it becomes a matter of interest to compare the relative size of these two divisions of the head: a comparison which ought to give the same result as the investigation of the relation between the mass of the brain and that of the cerebral nerves. To that end CAMPER devised the so-named *facial angle*, which is determined by an oblique line (*linea facialis*) drawn from the most prominent part of the forehead to the anterior margin of the incisor teeth, or to the anterior extremity of the intermaxillary bone, and by a horizontal line running from the external auditory passage to the inferior margin of the nasal cavity. Whilst the facial angle in man ranges from 70 to 85 degrees, it is much more acute in the other mammals, and in monkeys reaches only 40 degrees or more, whilst in other mammals it descends to 25 degrees, or even less. But since the facial angle can afford no sure results unless the outer surface of the frontal bone be nearly parallel to the inner, and this, from the great development of the frontal sinuses, in many mammals is not the case, CUVIER preferred to compare the area of the cranial cavity with that of the facial bones, as determined by sawing through the bony head longitudinally in the mid plane. The ratio between these two areas, and so also the facial angle, is modified by age; in the monkeys especially the development of the posterior molar teeth presses the jaws forwards, by which the head assumes a more animal character than in younger individuals. The orang affords a striking example of this; formerly the figures and the dimensions of the orang's skull were all taken from young specimens; from these were derived the values of the facial angle given in elementary works; but the facial angle becomes much more acute, and all that is human in the character almost entirely disappears in the *Pongo* of WURMB, which is now known as the adult orang.

Most mammals have teeth; the genera *Manis* and *Myrmecophaga* are however entirely destitute of them. In the duck-mole (*Ornithorhynchus*) horny teeth are present; of the same kind are the teeth of *Rytina* ILLIGER; they consist of tubules placed vertically,

and contain a very small quantity only of bone-earth. In the whales (*Balænæ*) there are horny laminæ (the so-named baleen) in the upper jaw which stand transversely behind one another; the lower jaw has neither baleen nor teeth, but, when the mouth is closed, surrounds the outside of the baleen. The largest laminæ lie at the outer margin; their form is that of a trapezium of which the outside is much longer than the inside. Next to these large laminæ, on their inside, lie many smaller, which are also whiter and softer. In every lamina an external and an internal substance may be distinguished; the external or cortical substance consists of horny plates lying close upon each other; the included medullary substance is formed of parallel descending tubes which, at the inferior margin of the horny lamina, pass into bristly fibres. These tubes do not extend so high towards the superior maxillary bone as the plates of cortical substance. Thus a space or cavity is left at this part, which receives the germ-membrane, a fold of thick vascular skin on which the balleens rest. This fold forms filamentous elongations which proceed in the tubular, internal substance of the baleen, and are accompanied by vessels in the same direction. Between the laminæ of baleen is a white substance, which seems to require only a slight change to be transformed into horny matter[1]. In the dolphins the teeth are not formed in sockets but in the gum, and the margins of the jaw are elevated to enclose the teeth[2]. All these teeth are conical and nearly similar; the middle teeth only seem to be somewhat larger than the anterior and the posterior. In this respect therefore the dolphins resemble many fishes and lacertine animals. In the rest of the mammals the teeth are formed in the alveoli.

The tooth has a germ or matrix (*pulpa dentis*), by which the bony substance (*dentine* OWEN) is secreted, or which is changed into that substance by ossification, and of which the residue occupies a cavity in the tooth when formed. The crown is formed first and afterwards the root. The crown is covered with enamel, a very hard substance which consists of fibres directed towards the axis of the tooth. In the *covered* teeth (*dentes obducti*), as those of man, the quadrumanous and carnivorous animals,

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[1] Compare F. C. ROSENTHAL *Abhandlungen der Königl. Akad. der Wissenschaften zu Berlin, aus dem Jahre* 1829, Berlin, 1832, s. 127—132, Tab. I, III.

[2] HUNTER *Phil. Transact.* 1787, p. 398; see also OWEN *Odontography*, pp. 358, 359.

the crown is covered entirely and uniformly by a layer of enamel. In other mammals the enamel penetrates into the dentine, and thus forms folds (*dens complicatus* s. *semicompositus*), and in some again these folds extend so far towards the root of the teeth as to divide them into different laminæ (*dentes compositi* s. *lamellosi*). The molars of the elephant afford an example of the last kind. Since, now, the act of mastication wears away the less hard dentine more quickly than the enamel, projecting lines arise on the crowns of the semi-complex and complex teeth, with furrows between them, as may be readily seen in such teeth as the molars of the ox. The plates of the complex teeth are held together by an intermediate substance named cement (*cementum* s. *crusta petrosa*); it is formed by ossification of the capsule, within which the germ of the tooth exists, and which is here folded. This cement or bony substance covers also the roots of the teeth in mammals. Enamel is not present in the teeth of all mammals; dentine on the contrary and cement exist in every tooth. The division of the teeth into incisors, canines and molars is derived from human anatomy. These three kinds do not always co-exist where teeth in general are present, thus the rodents have no canine teeth; the number also of the teeth is very different in different mammals; but on this subject we refer to the characters of the genera in the Systematic Arrangement of this class. The first teeth (deciduous or milk-teeth) are shed by mammals[1], as they are by man, after a certain time, to make room for other permanent teeth[2].

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[1] That the hog forms no exception in this respect, as may be found stated by ARISTOTELES, needs scarcely to be insisted on, although BUFFON repeats the mistake (*Hist. nat.* v. p. 110). Compare on the teeth amongst others F. CUVIER *Des dents des mammifères*, Paris, 1825, 8vo, R. OWEN *Odontography*, London, 1840—1845, 2 Vols. 8vo, and by the same the copious article *Teeth* in TODD'S *Cyclopædia of Anat. and Physiol.* IV. 1852, pp. 864—935. On the microscopic structure of the teeth much is due to the investigations of LEEUWENHOECK especially, which within the last few years have been confirmed by modern observers, as PURKINJE (see FRÆNKEL *de penitiori dentium humanorum structura observationes*, Wratislaviæ, 1835), RETZIUS (*Mikroskopiska undersökningar öfver Tändernes Structur; Kongel. Vet. Akad. Handlingar*, 1836, Stockholm), OWEN l. l. and others.

[2] [The *incisors* are those implanted in the intermaxillary (*premaxillary* OWEN) bone and the corresponding teeth of the lower jaw, whatever their shape and size. "The tooth in the maxillary bone which is situated at, or near to, the suture with the premaxillary is the *canine*, as also is that tooth in the lower jaw which, in opposing it, passes in front of its crown when the mouth is closed. The other teeth of the first set are the *deciduous molars*; the teeth which displace and succeed them vertically are the *premolars*; the more posterior teeth, which are not displaced by vertical successors,

We have already said that the mammals have two jaws; but the under-jaw alone is moveable. In man this motion is threefold; first the jaw can be depressed and again raised, next can be extended forward and again retracted, and lastly can be moved obliquely to the left side and the right, whilst one of the condyles rotates in the articular cavity of the temporal bone as round its axis, and the other slides somewhat out of its cavity forward and inward. These three motions are rendered possible by the roundness of the condyle and the slight depth of the articular cavity. In the mammals the motions are usually more limited. In the carnivores the articular condyle is broad, and is received in a deep, transverse groove placed between projecting lines, in such a way that motion forward and backward is prevented, whilst the under-jaw in dilacerating animal food is principally capable of powerful elevation and depression. In the rodents the condyle is longitudinal, in the same direction as the long dimension of the lower-jaw, and is received in a spacious, shallow cavity below the malar process of the temporal bone; hence the under-jaw can glide forward and backward with facility, which in gnawing their food constitutes its principal motion. In the ruminants, finally, the articular groove is very shallow, the condyle transverse and flat, and the

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are the *molars* properly so called." OWEN in TODD'S *Cyclop.* IV. p. 903. The typical dentition of diphyodonts as determined by OWEN from the forms of mammalia first introduced into this planet, whether carnivorous or graminivorous, was 3 incisors, 1 canine, and 7 succeeding teeth above and below. Three of the seven may be premolars and four may be true molars, or four may be premolars and three true molars; the first being a character of the placental diphyodonts, the second of the marsupial. True molars are a continuation of the first set of teeth backward, and these are all developed in the same primary groove of the fœtal gum. The successional teeth, or the premolars, are formed from tooth-germs developed on the side of the deciduous teeth, and therefore grow in a secondary groove. These secondary tooth-germs are three in number, in one group only. When the premolars and molars are below the typical number the absent teeth are missing from the fore part of the premolar series, and from the back part of the molar series, the most constant teeth being the fourth premolar and the first true molar. These having been determined in any case by observation of the development, the rest of the premolars are counted from the last forward (4, 3, 2, 1), of the molars from the first backward (1, 2, 3). The typical dentition is expressed by the following formula, $i.\frac{3-3}{3-3}$, $c.\frac{1-1}{1-1}$, $p.\frac{4-4}{4-4}$, $m.\frac{3-3}{3-3}=42$, for placental diphyodonts. OWEN l. l. and also *On the Characters of the class Mammalia*, in *Proceedings of the Linn. Soc.* II. No. 5, 1857, pp. 7—9.]

[1] [The order *Monotremata, Edentata* and *Cetacea* generate a single set only of teeth (*Monophyodonts* OWEN); all the rest generate two sets (*Diphyodonts* OWEN).]

lower jaw narrower than the upper; by all these peculiarities the lateral motion of the lower jaw is facilitated. To these different modifications of the articulation the arrangement also of the muscles corresponds. Thus, for instance, the carnivorous animals have a very powerful temporal muscle, which in most of the rodents is feebly developed; in the ruminants the external pterygoïd muscle is of peculiar strength[1].

With the exception of the true or carnivorous *cetacea*, all mammals have salivary glands; they are more highly developed in proportion as the food is masticated for a longer period, more in the vegetable feeders than in the carnivorous animals. In man three salivary glands are present on each side. The *parotid* gland lies behind the ascending branch of the lower jaw; its excretory duct (*ductus stenonianus*) runs across the masseter muscle, perforates the buccinator muscle, and opens into the cavity of the mouth in the neighbourhood of the molars of the upper jaw. This gland is large in the horse, in the ruminants, in the pachyderms, in the beaver and the kangaroos; small, on the contrary, in the dog, and particularly small (*rudimentary*) in the seal (*Phoca*). The submaxillary gland lies on the inside of the angle of the lower jaw, near the frenum of the tongue. In most carnivores and in the edentates it superposes the parotid in size; in *Dasypus*, where it extends to the great pectoral muscle, its efferent ducts meet in a muscular oval vesicle which terminates forward in the excretory duct[2]. Lastly, under the anterior part of the tongue, lies the sublingual gland, which is always provided with several excretory ducts (*ductus Riviniani*), and which in some mammals is wanting. The saliva has not in all mammals the same composition; in the mean the fluid consists in great part of water, and contains only a very small proportion ($\frac{1}{100}$ or at least less than $\frac{2}{100}$) of solid matter; namely, salts, mucus, osmazom, and a peculiar matter (*salivin*), soluble in water, insoluble in alcohol.

Besides the proper salivary glands there are many small glands on the inside of the mouth and on the palate (mucous crypts), by the secretions of which the food is moistened.

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[1] Compare CUVIER *Leçons d'Anat. comp.* III. pp. 29—60; TIEDEMANN *Zoologie*, I. s. 251, 252.

[2] RAPP *Anat. Unters. über die Edentaten* (1e Aufl.) Tubingen, 1843, 4to, s. 54, Pl. VII. A similar extraordinary development of this gland exists in the Ant-eater. See OWEN *Trans. Zool. Society*, IV.

The cavity, which forms the commencement of the alimentary canal, the gullet (*pharynx*), is wider above and passes below into the narrower *œsophagus;* it is formed by a continuation of the integuments of the nasal cavity and of the mouth, and is surrounded by many muscles which are inserted into different parts of the tongue-bone, into the cartilages of the larynx, and into the sphenoïd and temporal bones. In the true cetaceans the larynx ascends high up in the pharynx to the nasal cavity, so that the food descends in deglutition on each side of the larynx, and water is thus prevented from entering the windpipe[1].

The œsophagus is a nearly cylindrical tube, which runs through the cavity of the thorax, and lies towards the vertebral column; usually it is long, and forms the narrowest part of the intestinal canal. The muscular coat consists of two layers of fibres; the external layer is in man composed of longitudinal, the internal of transverse circular fibres. In most mammals the fibres of the two layers are turned spirally and run in two opposite directions. The mucous membrane and the innermost covering of epithelium form longitudinal folds which become more conspicuous on contraction of the muscular coat. The œsophagus of some mammals has in addition at the inferior extremity transverse, circular folds; they may be observed in the tiger, the lion, and other carnivorous animals[2].

The œsophagus when it has perforated the diaphragm passes, sometimes after continuing its course for a space in the abdominal cavity but in most mammals almost immediately below the diaphragm, into the stomach. In most mammals the stomach is simple, as in man. Often the cardiac portion is divided by a constriction from the pyloric portion. In many rodents this constriction is very conspicuous; there is an accumulation of glands at the cardia of the stomach, and in some species of the genus *Myoxus* this glandular part forms essentially a peculiar dilatation of the stomach[3], a disposition which corresponds with the structure of the stomach in birds (see above, p. 336).

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[1] See a figure in CAMPER *Cétac.* Pl. L; and another in CARUS *Tabulæ Anat. comp. illustr.* Pars IV. 1835, Tab. VII. fig. IV.

[2] See HOME *Lect. on Comp. Anat.* Tab. XI. In the horse is a spiral valve which makes a turn and a half. See a figure by GURLT in MECKEL'S *Archiv f. d. Physiol.* VI. Taf. 4, fig. 8.

[3] HOME l. l. Tab. XIII.

In the kangaroos the stomach is elongate, provided with cellular or sacciform dilatations, and resembles a part of the large intestine[1]. Also in *Pteropus* amongst the bats, and *Semnopithecus* amongst the monkeys, the stomach is intestine-like in form; in the last genus the cardiac portion has a smooth surface internally, and is divided by a remarkable dilatation from the second division formed of a double row of sacs; the third or pyloric portion is elongate and has also some dilatations less perfectly distinct, but at the extremity becomes of a more simple structure[2]. In the sloth and the carnivorous cetaceans also the stomach is composed of different divisions. But in the ruminants especially does the compound stomach deserve a particular notice. The first stomach, which is named the *paunch* (*rumen, magnus venter, l'herbier, der Panzen*), lies on the left side, terminates in two blind sacs, is very large, and on the inner surface is beset with a quantity of hard, sometimes almost horny papillæ. The second stomach, the *hood* or *honey-comb bag* (*reticulum, le bonnet, die Haube, der Netzmagen*), is much smaller, lies on the right side of the preceding, has a round form and is covered reticulately on the inner surface with four, five, and six-sided deep cells, and on the entire surface furnished with small papillæ which on the margins of the cells present the appearance of small teeth. Between these two stomachs the opening of the œsophagus is situated. On the right side of the second stomach lies the third which communicates with it by a narrow aperture, and which is named the *manyplies* or *psalterium* (*echinus, omasum, le feuillet, der Blatter-magen, Psalter*). It is elongate and beset on the inside by many broad, longitudinal folds, which arise from the interior like the leaves of a book, whilst others less prominent alternate with the larger folds[3]. This third stomach communicates by a very wide opening with the fourth (the *red, abomasum, la caillette, der Labmagen*), which is of considerable size, and becomes narrower towards the duodenum; its form has some resemblance to that of the human stomach; it is

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[1] HOME l. l. Tab. XIX; CARUS l. l. Tab. VIII. fig. X.

[2] This arrangement of the stomach was first described by OTTO in *Semnopithecus leucoprymnus*, afterwards by OWEN in *S. entellus* and *S. fascicularis*, *Transact. of the Zool. Soc.* I. pp. 65—70, Pl. 8, 9.

[3] See this figured by BERTHOLD in his *Beiträge zur Anatomie, Zootomie u. Physiologie*, Göttingen, 1831, 8vo, Tab. IX. fig. 6. VINK found 96 folds in the ox, of which 24 were larger, 24 of middle size, and 48 small; *Lessen over de Veepest*, bl. 18, 19.

furnished on the inside with longitudinal folds, but these are far less deep and much fewer in number, and consequently more remote from each other than the laminæ of the manyplies. The first three stomachs are apparently divisions of the blind sac which is found on the left side of the stomach in man (*fundus ventriculi*), and which in the carnivores is very small. The fourth stomach also is at first, whilst the animal still sucks, the largest, and the paunch increases in capacity only at a later period, the dilatation depending upon the food, as DAUBENTON demonstrated by feeding one lamb with bread and another with grass. The first two stomachs, therefore, are reservoirs, in which the large quantity of food, which ruminants are used to appropriate in a short time, is macerated, and in a physiological point of view correspond in some degree with the buccal pouches of certain monkeys. From these first two stomachs the food thus macerated is returned in small portions along the œsophagus upwards to the mouth, is chewed a second time, or rather is now for the first time finely comminuted by the molar teeth, and is then conveyed downwards again by the œsophagus. The œsophagus conveys the food thus swallowed a second time in a canal or channel which, as a continuation of itself, passes along the inside of the hood to the manyplies[1]. In the camel, the lama, and the *Moschus javanicus*, the third stomach or manyplies is wanting; in the last-named animal the red is smooth and without folds[2]. In the camels and lamas the paunch is destitute of papillæ internally, but has large cells below and at the side in which water is preserved or separated. In the hood the cells are smaller and more numerous[3].

The gastric juice, which is secreted during digestion when the food stimulates[4] the walls of the stomach, is acid. In ruminants

[1] Compare DAUBENTON *Mémoire sur le mécanisme de la rumination*, &c., *Mém. de l'Acad. des Sc. de Paris*, 1768, pp. 389 et suiv., P. CAMPER *Lessen over de thans zwevende veesterfte*, Leeuwarden, 1769, 8vo (included also in the *Œuvres de* P. CAMPER, Paris, 1803, Tome III. pp. 1—157, Pl. 28); H. VINK *Lessen over de herkaauwing der Runderen*, Rotterdam, 1770, 8vo, with 2 plates, &c.

[2] Compare W. V. RAPP, ERICHSON'S *Archiv f. Naturgesch.* IX. 1843, s. 43—54, Tab. II. and F. S. LEUCKART, MUELLER'S *Archiv*, 1843, s. 24—27, Tab. II. fig. 3.

[3] See the beautiful figures in HOME'S *Lectures on Comp. Anat.* II. Tab. 23—25; compare RAPP *Ueber die Wassercellen im Magen der Kameele* in HEUSINGER'S *Zeitschr. für die organ. Physik*, I. 4, s. 449 u. ff.

[4] The mucous membrane of the stomach in man and most mammals consists of tubular gland-sacs which are placed parallel to each other and perpendicular to the surface; by their blind extremity, simple or branched, they terminate in the cellular

the food in the first and second stomach is penetrated by alkaline fluids, and only after having been ruminated does it imbibe in the manyplies and the red an acid gastric juice. Thus it is here alone that a true digestion, similar to that in the simple stomach of other animals, is effected.

The chyme, the product of stomachal digestion, passes into the duodenum, the first part of the small intestine. The small intestines are mostly longer than the large intestines, and on the inside are beset with *villi* or elongated folds. Villi are commonly present, in few instances only (as in the mole, the genus *Chrysochloris*, the *Ornithorhynchus*, &c.) are they absent. At the union of the large and small intestines there is usually found a cœcum; in one species of *ant-eater* (*Myrmecophaga didactyla*) there are, as in birds, two cœca at the entrance of the small intestine into the large; in *Myrmecophaga jubata* the cœcum is absent. In *Hyrax* there is a short and wide cœcum in the usual position, whilst lower down in the large intestine (*colon*) there are two other blind and conical appendages placed side by side. It has been supposed that a second digestion, a final separation of the nutritious matter of the chyme, is effected in the cœcum, and in support of the opinion the resemblance between this part in some animals and the stomach in other mammals has been adduced. The excrements, consisting of the unaltered residue of the chyme, of bile, and mucus, are now formed and gradually assume a greater consistence in the course of the large intestines. The termination of the intestinal canal is usually distinct from the sexual aperture, but in the duck-mole and in *Tachyglossus* there is a *cloaca* as in birds. At the end of the rectum glands are frequently situated which secrete a fatty and strongly odorous fluid, as in the badger (*Meles*), the hyena, &c.

The relative length of the intestinal canal is usually greater in mammals than in the other classes of vertebrate animals, but differs, however, in the different genera. In general the intestinal canal is longest in the vegetable feeders; thus in the ox it is more than two and twenty times the distance from the mouth to the anus, and in a full-grown animal is one hundred and fifty feet long; in the

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coat, whilst their openings are on the inner surface of the stomach. Compare BISCHOFF *Ueber den Bau der Magenschleimhaut*, MUELLER'S *Archiv*, 1838, s. 503—525. These *folliculi* secrete the gastric juice.

carnivores on the contrary it is usually short; in the lion the proportion stated above is as 3 : 1; the intestinal canal seems to be still shorter in some insectivorous mammals. In the hyena the proportion is as 8 : 1, and in the *Phocæ* the intestinal canal is still longer. In man the above proportion is usually stated as 6 : 1[1]. But different individuals of the same species vary in this respect. At different periods of life also the proportion differs. In the fœtus at the earliest period the relative length is very small; at the last period of fœtal life and in early childhood on the contrary it is larger than in the adult period of life[2]. But not the length solely of the intestinal canal, but the circumference also, the valves, the folds, the villi more or less numerous are to be estimated; these all multiply the absorbent surface, and thus a shorter canal may be equal in this respect to a longer. In the seals and the hyena the intestinal canal is narrow, and thus the relative length which is so remarkable is reduced to correspondence with the animal food of which they make use[3].

The liver is situated below the diaphragm, chiefly on the right side, as in man; but the greater the number of its divisions the more does it extend to the left side. On the whole the liver is more divided into lobes in the carnivorous animals than in the vegetable feeders; it is small on the contrary and little divided, especially in mammals with divided or compound stomach[4]. The gall-bladder is wanting in a greater number of species of this class than in any of the other classes of vertebrate animals; it is not present in the carnivorous *Cetacea*, in the rhinoceros, elephant, tapir, the horse, the sloth, the hamster and some other rodents, and, amongst the ruminants, in the camels, lamas and

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[1] The second edition of CUVIER *Leç. d'Anat. comp.* IV. 2, 1835, pp. 182—195, edited by DUVERNOY, contains copious tables. In *Phocâ vitulina*, where this proportion is differently stated, I found it as 1 : 18 or 1 : 19.

[2] Compare MECKEL in his *Archiv f. die Physiol.* 1817, III. s. 61—65.

[3] On the digestive organs, besides the general works of CUVIER, HOME, MECKEL, &c., the work of J. W. NEERGAARD, *Commentatio anatomico-physiologica sistens disquisitionem an verum organorum digestioni inservientium discrimen inter animalia herbivora, carnivora et omnivora reperiatur*, Gottingæ, 1804, 4to, may be consulted, in which these parts are described in the horse, ox, hog and dog.

[4] The distinguishing of the different parts occurring in the liver by special names, as was proposed by DUVERNOY, we cannot detail here. See his *Études sur le Foie; Ann. des Sc. nat.* IV. 1835, *Zool.* pp. 257—269.

deer[1]. In the carnivorous animals, on the other hand, it is always present, as also in the monkeys. In most mammals the bile is carried to the gall-bladder by the same route as that by which it is again conducted from it (the *cystic duct*); in some, however, as in the ox, there are *hepatico-cystic* ducts, which were formerly attributed incorrectly to man[2]; they are branches of the hepatic duct which run to different parts of the gall-bladder, and pour the bile into it. In most cases the bile-duct of the liver joins with that of the gall-bladder to form a common canal (*ductus choledochus*), which conveys the bile into the duodenum. Usually also the excretory duct of the pancreas terminates in this common canal, close to its opening into the intestine. It is thus in man, although in the fœtus these ducts have distinct openings into the intestine, and that of the pancreas lies in front of the bile-duct. The bile-duct before it opens into the intestines runs for a space between its muscular and mucous coats, and sometimes forms a dilatation here[3].

The pancreas is placed behind the stomach between the spleen and the duodenum; commonly it is divided into two lobes. The smaller excretory ducts unite to form one, sometimes two larger ducts. The spleen lies near the stomach, in the ruminants near the first stomach or paunch; it is ordinarily elongate and simple. In the dolphin it is divided into several small distinct masses, of which however the anterior mass much surpasses the rest in size, whilst these, of variable number, are suspended to branches of the splenic artery[4].

The cavity of the abdomen is lined by a serous membrane, the *peritoneum*. A duplicature of the peritoneum called the *omentum* or *epiploon* is suspended from the under and fore part of the stomach. To other duplicatures of the peritoneum the intestinal canal is attached. Of these the chief is named the mesentery; the

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[1] It is remarkable, that in the giraffe, according to OWEN, it is sometimes wanting, sometimes double. The statement of ARISTOTELES, that in the sheep in *Eubœa* it is absent (in which animal it occurs elsewhere), obtains from this fact some credibility. *Hist. Animal.* I. c. 14.

[2] Compare HALLER *Elem. Physiol.* v. pp. 537—541.

[3] As in the elephant where the dilatation is divided by transverse partitions. See CAMPER *Œuvres*, II. pp. 124, 125, Pl. XIV.

[4] TYSON counted 12 spleens (HALLER *Elem. Physiol.* VI. p. 388), STANNIUS 18; in *Monodon* also he found three or four subsidiary spleens. *Vergl. Anat.* s. 433.

lymphatics run between its laminæ, and the glands belonging to the lymphatic system are situated there. The mammals are the only vertebrate animals in which conglomerate or lymphatic glands are met with in the mesentery. Commonly they are larger and less numerous than in man, and often unite (in many carnivores) to form a single mass, to which the name of *Pancreas Asellii* has been given[1], in which case only a few small distinct glands occur in addition. The chyle, conducted to the conglomerate glands by the chyle vessels, is usually received by a single *thoracic duct*, which opens into the left subclavian vein[2]. Besides the glands in the mesentery, conglomerate glands occur in other parts of the body in greater number than in birds, and the lymphatics differ from those of other vertebrate animals in having valves more numerous and more perfect[3].

The heart consists as in the birds of two ventricles and two auricles, and is invested by the pericardium. The form of the heart is various; in the cetaceans it is broad, as also in the elephant, elongate in the dog, but round in most monkeys, obtusely conical in the horse, the ox, the orang outan and man. In man the heart is placed obliquely, and rests by one of its surfaces on the diaphragm; such also is the case in the orang and the chimpansee. In the rest of the mammals it is almost always placed more in a straight line, and either does not reach the diaphragm at all, or, as in most of the monkeys, with its apex alone[4]. In the septum of the auricles is seen the oval fossa, the remains of the aperture which in the fœtus is found at this part and is named the *foramen ovale*. This oval aperture is closed after birth, yet in the seals and other animals that live in water sometimes remains open. In the interior of the right auricle under the oval fossa and near the mouth of the inferior *vena cava* is seen the *valve of Eustachius*, which is wanting

[1] After the discoverer of the lymphatic system, ASELLIUS, who first observed these vessels in 1622 in the intestinal canal of the dog. *De lactibus sive lacteis venis quarto vasorum meseraicorum genere novo invento* GASPARI ASELLII Dissertatio. Mediolani, 1627, 4to.

[2] If there be a left and a right thoracic duct, the last unites with the first before the passage into the venous system.

[3] Here also compare the *Osservazioni* of PANIZZA referred to above (p. 339).

[4] The deep external separation of the venous and arterial halves of the heart in the herbivorous *Cetacea*, especially in *Halicore*, the *Dugong*, is remarkable. See figures in HOME, *Lectures*, IV. Pl. L; RAPP *Die Cetaceen*, 1837, Taf. VIII. (in a *fœtus*) &c.

in many mammals at the adult period. According to the investigations of RUDOLPHI on the other hand, the projecting superior margin of the fossa ovalis exists in many mammals in a highly developed state, which is commonly named *tuberculum Loweri*[1]. The right ventricle of the heart lies more forward in man than in the rest of the mammals. In this chamber is seen the tricuspid valve in place of the single, strong muscular valve of the birds; in the duck-mole, however, MECKEL found an arrangement similar in form to that of birds. At the origin of the great artery there is found in the deer and some other ruminants, as also in the hog, one or two small bones in the septum of the ventricles, which are cartilaginous in young animals.

The mode is various in which the principal stems arise from the arch of the great artery (*aorta*). This arch is always situated on the left side, in order to pass into the descending aorta. But before forming this arch, it gives off, close to its origin, two arteries (or, according to CAMPER, in the elephant a single artery) for the heart (*arteria coronaria*). From the arch itself there arise in man, in many monkeys, in the mice and some other rodents, the seal, the hedgehog, &c., three stems, on the right an *arteria anonyma*, as a short common trunk of the right carotid and right subclavian arteries, whilst on the left side each of these arteries arises by a distinct stem. A more usual arrangement appears to be that where there are only two stems; on the right side a short innominate artery, which then divides into the two carotids and the right subclavian, whilst the left subclavian, as the second stem, arises separately from the arch. This is what is found in the Lemurids and many monkeys, in most of the carnivores, many marsupiates and rodents. In the ruminants and the horse, the *aorta* immediately at its origin divides into an ascending branch, from which the two subclavians and the two carotids arise, and a branch which bends to the left downwards, the descending aorta. Other arrangements, so that, for instance, there are two distinct subclavians and a common stem for the two carotids, or two *arteriæ anonymæ*, each of which divides into a subclavian and a carotid, exist only in

[1] *Grundriss der Physiol.* II. 2, s. 331—333. Compare on the true nature of this part and on the septum of the auricles, the remarks of RETZIUS, illustrated by beautiful figures, in MUELLER'S *Archiv*, 1835, s. 161—170.

particular species of animals[1]. In some mammals the carotid artery forms within the cranium around the *hypophysis cerebri* a wonder-net, from which the *carotis cerebralis* arises; it is observed in the hog and the ruminants. In these animals the vertebral artery does not run to the brain, and does not penetrate the *dura mater*[2]. For other peculiarities in the course of the arteries we cannot afford to delay; as, for example, that the crural arteries in the *cetacea*, which have no hind limbs, are wanting; that the caudal artery (in man the small *arteria sacralis media*) is very wide and conspicuous in those species which have a strongly developed tail, &c. As to the veins, in some there are, as in the birds, two anterior or descending *venæ cavæ*, ex. gr. in the elephant, the duck-mole, many rodents; in the most, however, there is only one superior cava as in man. The external jugular veins are often very wide, where they convey the blood from the brain also, which in man and the monkeys is performed exclusively by the internal jugular veins. In the seals, the posterior cava, close to the liver, has a sacciform expansion, which receives five hepatic veins, and extends to the diaphragm; above the diaphragm the vein is again of the common width.

Wonder-nets occur in the vascular system of mammals at different parts of the body; commonly they have only been investigated on the arteries. They have been noticed on the blood-vessels of the limbs in *Bradypus*, *Myrmecophaga didactyla*, *Stenops*, *Tarsius*, *Dasypus* (*sexcinctus*[3]). In the Monotremes, especially in *Tachyglossus*, such vascular networks occur, but not so finely divided for the limbs[4]. The network of the cerebral carotid we have already

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[1] All these different arrangements have been observed in the human body also as animal modifications of form. See J. F. MECKEL *Tabulæ anatomico-pathologicæ*, Lipsiæ, 1820, folio, Fasc. II.

[2] See RAPP in MECKEL'S *Archiv für Anat. u. Physiol.* 1827, s. 1—13, Tab. I. II.

[3] CARLISLE was the first who observed this in the arteries of *Bradypus* and *Stenops*, *Philos. Transact.* for 1800, Part I. p. 98. Compare on this subject amongst others W. VROLIK *Disquisitio de peculiari arteriarum extremitatum in nonnullis animalibus dispositione*, Cum III. Tabulis æn. Amstelodami, 1826, 4to; OTTO in CARUS *Tab. anat. comp. illustr.* Fasc. VI. Tab. VIII. fig. 4 (veins of the lower limbs in *Bradypus tridactylus*), and SCHROEDER, VAN DER KOLK and W. VROLIK *Nasporingen omtrent vaatvlechten bij onderscheidene diervormen*, in the *Bijdragen tot de Dierkunde uitgegeven door het Genootschap*, Natura Artis Magistra, 1e Aflev. Amsterdam, 1848 (veins and arteries). In *Tarsius* these plexuses, according to BURMEISTER, occur in the hind limbs only.

[4] HYRTL *Das Arterielle Gefäss-System der Monotremen*, Wien, 1853, 4to.

noticed, but a branch of the external carotid also, the ophthalmic artery, forms in the ruminants and the cat a vascular plexus in the orbit[1], and a few years ago HYRTL discovered in the hog and the ruminants, wonder-nets in the nasal cavities, formed by the sphenopalatine artery[2]. Conspicuous vascular plexures occur also in the dolphins on the intercostal arteries and the iliac veins[3].

The respiratory organs are distinguished by the minute division of the bronchial tubes. The pulmonary vesicles are in immediate connexion with the delicate terminal branches of these tubes, and may, in contradistinction to the air-cells of reptiles, be named *terminal cells*, although the idea can no longer be maintained that every terminal branch of the *bronchi* forms by its blind extremity a single pulmonary vesicle. Air-sacs in connexion with the lungs, as they are observed in birds, are not present in the class of mammals. In most mammals the cartilaginous rings of the trachea do not form a complete circle, but leave an interspace on the posterior surface. In the dolphins, however, and some other mammals the rings are more perfect; in the whales the rings, according to the investigations of G. SANDIFORT[4], are interrupted by a membranous portion *on the anterior surface;* a peculiarity by which the wind-pipe of these animals is distinguished from that of all other mammals. Curvatures in the trachea have been observed in the three-fingered sloth alone, where the wind-pipe descends nearly to the diaphragm, and then curves upwards again before it divides into the two bronchi. As a rule there are two bronchi, one for each lung, although in the ruminants, the dolphins, and some other mammals, a third smaller bronchial tube occurs, which arises

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[1] RAPP, MECKEL'S *Archiv*, 1827, s. 8, 9; in the cat, figured by OTTO, in CARUS l. l. Tab. VII. fig. 4.

[2] *Beiträge zur vergleichenden Angiologie.* Wien, 1849.

[3] VON BAER *Nov. Act. Acad. Cæs. Leop. Car.* Vol. XVII. P. 1. pp. 393—408; BRESCHET *Histoire anatomique et physiol. d'un organe de nature vasculaire chez les cétacés*, Paris, 1836, 4to, avec pl. Comp. on the arterial system in general of mammals BARKOW *Disquisitiones circa originem et decursum arteriarum Mammalium*, Accedunt Tab. æn. IV. Lipsiæ, 1829, 4to, and by the same, *Disquisitiones recentiores*, &c. in *Nov. Act. Acad. Cæs. Leop. Car.* Vol. XX. P. 2, 1843, pp. 607 seq.

[4] *Bijdragen tot de ontleedkundige kennis der Walvisschen, Nieuwe Verhandelingen der Eerste Klasse van het Koninkl. Nederl. Instituut*, III. Deel, 1831.—Besides the general works on comparative anatomy (particularly the new edition of CUVIER, by DUVERNOY and MECKEL, *System der vergl. Anat.* VI. s. 364—474) on the respiratory organs of mammals may be consulted with advantage: A. LEREBOULLET *Anat. comp. de l'appareil respiratoire des animaux vertébrés*, Strasbourg, 1838, 4to, pp. 24—42.

above the ordinary one on the right side. The right lung is larger than the left, and has often one or two lobes more than it; sometimes the left is even altogether undivided. Both lungs are undivided in the *Cetacea*, the horse, and some few other mammals. Inspiration and expiration are effected by the same muscles as in man. We ought here to direct attention to the diaphragm, a muscular partition between the cavities of the thorax and abdomen, peculiar to mammals (p. 556), which is attached to the vertebræ, the ribs and the sternum, and is tendinous in the middle. When the diaphragm contracts, it descends; hence it is a muscle of inspiration, for when the capacity of the thorax is increased the air rushes into the lungs and the abdominal viscera are compressed. In some mammals a small bone is found in its tissue. The diaphragm is perforated by the œsophagus, the large artery, the posterior vena cava, different nerves and the thoracic duct.

Here we may conveniently turn our attention to the vocal apparatus of mammals. The trachea in mammals differs from that of birds in its relation to the production of voice. In mammals it merely conducts the air which is subservient to the formation of the voice; in birds, on the contrary, the sound itself, for in them the vocal organs are placed at its inferior extremity. Hence in mammals the voice cannot be produced if the air should find an outlet through a wound in the trachea. The larynx, in which the voice is formed, consists of different cartilages, and is situated at the top of the trachea. The cartilages are on the whole the same as in man. The *cricoïd cartilage* forms foundation of the entire larynx, and is broader behind, narrower in front; above it is placed the *thyroïd cartilage*, which consists of two laminæ, which meet at the fore part under an obtuse, or sometimes an acute angle. By two descending branches the thyroïd is connected with the cricoïd cartilage; it is connected to the tongue-bone by ligaments, which usually arise from its two superior processes or horns. The thyroïd cartilage thus forms the anterior part of the larynx. Two *arytænoïd cartilages* are fixed on the opposite side to the upper margin of the cricoïd cartilage. (In many mammals two roundish cartilages are placed upon the points of these, the *cartilagines Santorianæ*. Between the arytænoïd cartilages and the epiglottis there are often small cartilages named the *Wrisbergian*). The *epiglottis* is a tongue-shaped cartilaginous lamina, which is attached to the inside of the upper margin of the thyroïd cartilage. The larynx communicates with the cavity

of the mouth by a fissure (*glottis, rima glottidis*). It is situated between the inner margins of the *ligamenta thyreo-arytænoïdea;* commonly there lie on each side two folds above each other; the inferior (which include the so-named *glottis vera*) are named vocal ligaments (*chordæ vocales* of FERREIN). In the true *Cetacea* these inferior ligaments are absent. In most of the ruminants, on the other hand, the superior are absent (*ligamenta thyreo-arytænoïdea superiora, ligamenta glottidis spuriæ*). In the dolphins the arytænoïd cartilages in connexion with the epiglottis form a long pyramidal tube. In some cetaceans, a few ruminants, and many species of monkeys, air-sacs are found in different situations, mostly between the thyroïd cartilage and the tongue-bone, which communicate with the larynx. On the thyroïd cartilage is placed in mammals a vascular organ, a gland without an efferent duct, the *thyreoïd gland*[1].

The kidneys in mammals are situated in the lumbar region near the vertebræ, and on the outside of the sac of the peritoneum. In many mammals the right kidney is placed higher than the left; in man the reverse is observed nearly always. They are surrounded by a loose areolar tissue, in which much fat is accumulated; under this is the smooth proper membrane which covers the tissue of the kidneys. In the mammals (distinguished in this respect from all the other vertebrates,) that tissue presents itself in two forms, a *cortical* and a *medullary* substance. The proper secreting tissue of the kidneys consists of many tubules (*tubuli uriniferi s. Belliniani*), which pass from the papillæ in the pelvis of the kidney to its circumference. In the medullary substance their course is straight, and they divide a few times successively into two branches; afterwards their course in the cortical substance is tortuous, until they terminate in blind extremities near the surface of the kidney. The numerous arteries, which in the cortical substance divide pencil-wise into small clusters (*glomeruli s. corpora Malpighiana*), forming many pendulous rings or loops, have no immediate communication with these secreting tubes, but are

[1] On the vocal organs of the mammals may be compared amongst others CASSERII *De vocis organis Historia anatomica*, Ferrariæ, 1601, folio; L. WOLFF *Diss. anat.* (*præs.* B. A. RUDOLPHI) *de Organis vocis Mammalium*, Berolini, 1812, 4to; J. F. BRANDT *Observationes anatomicæ de Mammalium quorund., præsertim quadrumanorum, vocis instrumento*, Berolini, 1826, 4to, and especially WILLIS *On the mechanism of the Larynx, Transact. of Cambridge Philos. Soc.* 1832.

suspended, according to the discovery of BOWMAN, in dilatations, which are the blind extremities of the secreting tubes[1]. In the human embryo the kidneys consist of several masses or lobes; in some animals they continue in this form during the whole life, as in the carnivorous *Cetacea*, the seals, the bears. A urinary bladder always exists in this class, and the two *ureters* open into it. It appears to be smaller in the carnivorous than in the herbivorous animals. The so-named accessory kidneys (*capsulæ renales, renes succenturiati*) lie at the upper part of the kidneys; in the fœtus they are proportionally larger than in the adult. The function of these organs is unknown, but does not appear to have any relation to that of the kidneys.

There are two ovaries in mammals. In the duck-mole the right ovary is small and imperfect, which indicates a conformity with birds (see above, p. 347). In its tissue *Graafian vesicles* are found, on the structure of which we have already spoken above (p. 5). The size of the ovaries appears to have no direct relation to the fertility of the animal species. The oviducts are usually very narrow in mammals, and here bear the name of *Fallopian tubes*. The uterus and the oviducts are organs of the same kind and of the same texture; originally, therefore, the uterus is entirely double; it has two horns, and at the points of the so-named horns the oviducts are implanted. This condition which is transitory in the human fœtus persists in some mammals for the whole life; thus in the Monotremes, the Marsupiates, the Rodents, the uterus is double, and has two openings into the vagina, or in the most the uterus is two-horned, and the mouth and neck only are single; in the apes alone the uterus has an undivided *fundus* as in the human body. The muscular tissue of the uterus resembles the muscular tunic of the intestinal tube and of the urinary bladder. The abdominal aperture of the Fallopian tubes is usually widened like a

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[1] Compare on the internal structure of the kidney A. SCHUMLANSKY *Diss. inaug. anat. de structura Renum*, Argentorati, 1782, 4to; ÆM. HUSCHKE *Ueber die Textur der Niere* in OKEN'S *Isis*, 1828, s. 560; MUELLER *De glandularum structura penitiori*, Lipsiæ, 1830, fol. pp. 94—102; W. BOWMAN *Phil. Trans.* 1842, Pt. I. pp. 57—80.

See also the interesting explanation of HYRTL (a proof of pure love of truth) *Lehrbuch der Anatomie des Menschen*, 3te Auflage, 1853, s. 538. GERLACH adopts a lateral insertion also of these capsules (as though they were eversions of the secreting tubes); see his researches in MUELLER'S *Archiv*, 1845, 1848, and *Handbuch der Gewebelehre*, Mainz, 1850, s. 297, 306.

funnel, and in man and the apes is incised and curled at its margin, which can be applied to the ovary in order to receive the ovum from the Graafian vesicle when burst. In some mammals extra-uterine conception is prevented by a production of the peritoneum surrounding the ovary like a sac, and then uniting itself with the widened extremity of the tube, so that the sac can be inflated from the uterus; this is the case in *Lutra*, *Mustela*, *Phoca*, &c.[1]

The vagina in mammals is of various length; in the larger species, longitudinal and transverse muscular fibres may be detected in it; its inner surface is sometimes smooth in ruminants, sometimes furnished with longitudinal (as in the mare, the sow,) or transverse folds. Some mammals have a *hymen* or some folds that correspond to it[2]. In all mammals a clitoris appears to be present, and in those species of which the penis is supported by a small bone, such a bone is often found in this organ also of the female[3].

In the male mammals there are always two testes present. In some they are situated in the cavity of the abdomen, as in the human fœtus, close to the kidneys; such is the case in the Monotremes, the elephant, the daman, many edentate and all cetaceous animals. They are then retained in their place by a fold of the peritoneum. In other mammals they are situated near the integument of the inferior surface of the abdomen, and in many, as in most of the carnivores, the apes, &c. lie in a sac (*scrotum*) which hangs under the pelvis, or, in the marsupiates, in front of the pelvis. The tissue of the testes consists of numerous, long, narrow and tortuous tubes, of the same width throughout; they do not divide into branches and terminate in blind extremities. These tubes afterwards unite at that side which is towards the *epididymis* into fewer tubes, which by their communications form a network from which the efferent vessels of the seminal fluid pass into the epididymis, and unite to form a single tortuous tube of which the

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[1] See on this last peculiarity G. R. TREVIRANUS in the *Zeitschrift für Physiol.* 1824, 1, 2, s. 180—188, and E. H. WEBER in MECKEL'S *Archiv*, 1826, s. 105—109. Compare also on the *Uterus*, CUVIER *Leç. d'Anat. comp.* v. pp. 144—148 (new edit. VIII. pp. 30—41); see also BURDACH *die Physiologie als Erfahrungswissenschaft*, 2 Aufl. 1835, s. 154—157, Tab. IV.

[2] CUVIER *Leç.* v. pp. 131, 132.

[3] CUVIER l. l. p. 127. The urethra perforates the *clitoris* in the Lemurids; CUVIER *ibid.* p. 130.

vas deferens is the continuation. The two deferent vessels open above the root of the penis into the urethra almost always by two distinct apertures. In the Monotremes, the penis, according to the investigations of HOME, MECKEL, and more recently of DUVERNOY, is also perforated; but this canal, since the urine is poured into the *cloaca*, is not properly an urethra, but merely the seminal duct, and has in consequence received the name of *urethra seminalis*[1]. In most mammals the so-named *vesiculæ seminales* are met with; they are formed by eversions of the deferent vessels, and also contain seminal fluid in some mammals; they are, however, at the same time principally secreting organs and not mere reservoirs for the secreted *sperma*[2]. Their development and function are very various; they are particularly large and composite in the insectivorous *feræ*[3]. In most mammals there is one or more prostatic glands, which are placed around the commencement of the urethra, and mingle their fluid with that of the deferent vessels. In many mammals *Cowper's glands* also are present, which lie below the prostate on the *bulb* of the urethra; their tissue consists of vesicles connected in clusters, and, constantly surrounded by muscles, they sometimes have also a proper investment of muscular tissue with striped primitive bundles. These glands are wanting in the dog. A blind sac, already known to MORGAGNI, which in man opens into the urethra between the apertures of the *vasa deferentia*, has been observed in later times in many mammals, and from the investigations of WEBER and HUSCHKE has assumed an important morphological character as the remains of an *uterus masculinus* which is present in the fœtus[4]. The *penis* is always undivided,

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[1] *Mémoires de la Societé d'Hist. nat. de Strasbourg*, Tom. I. Livr. 2, 1833, pp. 1—10, Pl. II. Compare OWEN in TODD'S *Cyclop.* III. p. 392.

[2] J. HUNTER *Observations on certain parts of the animal Œconomy*, London, 1837, 8vo (ed. R. OWEN), pp. 20—33;—S. R. PITTARD *Vesiculæ seminales* in TODD'S *Cyclop.* IV. pp. 1429—1436.

[3] See for example the figures given by many writers of the male organs of propagation of the hedgehog, as: CARUS *Tab. Anat. comp. ill.* Fasc. V. Tab. 9, fig. 5; *Catalogue of the comp. Anat. in the Museum of the Coll. of Surg.* IV. Pl. 54, 55; TREVIRANUS *Beobacht. aus der Zoot. u. Physiol.* 1839, Tab. 17, 18; those of the mole by MUELLER *De Glandular. secern. struct. penit.* Tab. III. fig. 3, &c.

[4] See E. H. WEBER in the *Bericht der Versamml. der Naturforscher zu Braunschweig*, 1842, s. 64; HUSCHKE in his edition of S. T. SOEMMERRING'S *Lehre von den Eingeweide*, Leipzig, 1844; J. VAN DEEN in *Nieuw Archief voor binnen-en buitenl.*

and consists of two spongy bodies containing many blood-vessels and a single spongy body which surrounds the urethra[1]. In many marsupials a double gland is present[2]. In the feline genus the glans is beset with horny spines; in other mammals also, particularly rodents, horny parts occur as plates or scales on this part. In many mammals, the carnivores especially, there is found a small bone in the gland, which is continued more or less into the tissue of the penis.

Milk-glands (*mammæ*) exist in all mammals; they vary in number and position; in some, as the whales, they are placed in the neighbourhood of the external sexual organs, but in all on the inferior surface of the body. In the male sex they remain undeveloped, but in the female they secrete, especially for a longer or shorter time after parturition, the milk which is the food of the young. In the female of the duck-mole there is a large mammary gland on each side consisting of long blind sacs, cellular internally; the efferent ducts open on a small, flat, oval space without any nipple[3].

Impregnation is always effected in mammals by a real copulation. One or more Graafian vesicles burst and the ovum, very small in this class, escapes from them; this discharge of the ovum

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Geneeskunde, 1847, (and in V. SIEBOLD *u.* KOELLIKER *Zeitschr. f. wissensch. Zoologie*, I. 1849, s. 295—346, Tab. 20, 21), and especially R. LEUCKART in article *Vesicula prostatica*, TODD'S *Cyclop.* IV. pp. 1415—1429, who unites the opinion of H. MECKEL (he recognised in it a male *vagina*, *Zur Morphologie der Harn- und Geschlechts-werkzeuge der Wirbelthiere*, Halle, 1848, s. 48) with that of WEBER, and considers the Weberian organ to be a *sinus genitalis*, which in the female animal is developed into *uterus* and *vagina*. To me the opinion of MECKEL seems the most probable; if the *corpus uteri* and the *vagina* be derived from the Weberian organ, the *cornua uteri* still remain, and the hypothesis, according to which the uterus arises from two different elements (a vaginal portion and that of the horns proceeding from the two Fallopian tubes), is not recommended by its simplicity.

[1] In dogs the spongy body of the urethra forms a tubercle at its anterior part which swells on copulation; see a figure in PANIZZA *Osservazioni*, Tab. I, copied by CARUS in his *Tab. Anat. comp. ill.* Fasc. V. Tab. 9, fig. 9.

[2] See a figure in CARUS l. l. fig. 6. Compare on the male sexual organs of mammals, besides the general works on comparative anatomy, F. LEYDIG in V. SIEBOLD *u.* KÖLLIKER *Zeitschr f. Wissensch. Zool.* II. 1850, s. 1—57. On the penis especially CUVIER *Leçons d'Anat. comp.*, sec. éd. Tome VIII. pp. 197—246.

[3] J. F. MECKEL *Ornithorhynchi paradoxi descriptio anatomica*, Lipsiæ, 1826, fol. pp. 53, 54, Tab. VIII. fig. 5; OWEN *Phil. Trans.* 1832, and in TODD'S *Cyclop.* III. pp. 402—405. *Tachyglossus* presents a similar arrangement; see a small figure in BARKOW *Zootomische Bemerkungen*, Breslau, 1851, 4to, fig. 14.

is an independent act of the female genital organs unconnected with copulation. The ovum is now received by the mouth of the Fallopian tubes and conveyed into the cavity of the uterus. The time required for this transit is very different in different mammals, from three to ten or twelve days or even more. The membrane which encloses the ovum (*zona pellucida*) during the passage through the tube is fortified by a layer of albumen, and at a later period is, in connexion with the peripheric part of the animal layer of the germinal vesicle, developed into the *chorion* by which the embryo in the uterus is invested as an external covering. Further, this chorion in man and the apes is surrounded on the outside by investments which do not properly belong to the ovum, but are products of the uterus (*membrana decidua vera* and *reflexa*). By these or by the epithelium of the mucous membrane immediately the ovum is brought in connexion with the uterus. Afterwards a closer union is effected by means of the blood-vessels which with the *allantois* penetrate to the *chorion*; in this way the placenta is formed, a rooting or implanting of the ovum in the uterus by means of the umbilical vessels; it occurs in the mammals alone, but is however wanting in the Marsupiates and Monotremes, in which the allantois continues small and does not extend as far as the chorion. When the *allantois* grows round the entire ovum, the *placenta* may extend over the whole chorion (pachyderms, solidungulates), or may be collected into small groups as eminences on the *chorion* (ruminants), or form a ring round the ovum (carnivores). In the rodents, the apes and man the *allantois* is connected with a limited part only of the *chorion*, and to this part alone the formation of the placenta is restricted. But notwithstanding this connexion, neither in man, nor in the mammals is there any immediate passage of the blood from the vessels of the mother into those of the fœtus, nor, conversely, from those of the fœtus into those of the parent animal[1].

[1] The development of the *embryo* in mammals proceeds in a mode similar to that in birds (see above, pp. 352—357). In addition to the second part of Von Baer, *Ueber Entwickelungsgeschichte der Thiere*, Königsberg, 1837, s. 164—279, four excellent works of Th. L. W. Bischoff may here be studied: *Entwickelungsgeschichte des Kaninchen-Eies*, Braunschweig, 1842, 4to, *Entwickelungsgesch. des Hunde-Eies*, ibid. 1845, 4to, *Entwickelungsgesch. des Meerschweinchens*, Giessen, 1852, 4to, and *Entwickelungsgesch. des Rehes*, ibid. 1854, 4to. (Here, in *Cavia cobaya*, the singular anomaly occurs, that the mucous layer lies on the outside of the germinal membrane, and that thus the embryo has its back turned to the inside of the germinal vesicle.) Amongst the

The duration of pregnancy, as well as the number of young that commonly come into the world at each litter, is very different in different genera of mammals. The diminutive size and the slight development which the young of Marsupials present on leaving the uterus is remarkable. They are then received in a bag or between two folds of skin at the abdomen. The small bones attached to the fore part of the pelvis (p. 564) serve to support this sac. To the nipples placed at the inside of the sac, which are very long, but which except at the time of suckling are drawn in by reversion like the finger of a glove[1], the young are now fixed and continue to hang for some weeks. Afterwards, when they are more developed, they quit the nipple, but the sac remains a hiding-place for some time, and to it the young animals resort when danger or pursuit threatens. Amongst the marsupiates which have no sac, but of which the teats are placed between two folds of skin, some bear their young on their back during the period of more advanced development, whilst the tails of the progeny are convoluted round that of the parent (*Didelphis murina*, *dorsigera*, &c.).

The central nervous system of mammals corresponds to that of birds in this respect, that the mass of the spinal marrow is much less than that of the brain. In mammals also, as in the rest of the vertebrates, a narrow canal often runs longitudinally in the middle of the spinal marrow[2]; in others, however, as in man it is present in the embryonic state alone. The number of pairs of spinal nerves differs in different species, as might be inferred from the different number of vertebræ. Since the *dura mater* which covers the spinal marrow or cord extends further back in the vertebral canal than the cord itself, the last pairs of nerves before perforating this membrane have an oblique course, and the *cauda equina* is formed which is scarcely ever met with in the cord of the other vertebrates. This arrangement is more conspicuous in proportion as the cord is shorter; the bats and the hedgehog are distinguished by an unusually short spinal marrow, in them it ends before the last dorsal vertebra. The inferior cervical nerves form with the first

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earlier works compare OKEN *und* KIESER *Beiträge zur vergl. Zool., Anat. und Physiol. des Darmkanals aus der* Vesicula umbilicalis *dargestelt im menschlichen Embryo,* Mit 2 Kupfert. Göttingen, 1810, 4to.

[1] Compare J. MORGAN *Linnæan Transact.* XVI. pp. 455—463, Pl. 26.

[2] See W. SEWEL *Philos. Transact.* 1809.

pair of dorsal nerves a plexus for the anterior limbs; at the origin of these nerves the cord exhibits a swelling; a second occurs lower down where the lumbar and sacral nerves arise which form the plexus for the hind limbs. The phrenic nerves, peculiar to mammals, have their origin principally from the fourth pair of cervical nerves.

The brain is distinguished at its base from that of other vertebrates by a commissure of the hemispheres of the cerebellum passing across the *medulla oblongata;* it is named *pons Varolii*, and is found in all mammals. The great transverse commissure of the hemispheres of the cerebrum is with the exception of the Monotremes and Marsupiates[1] present in all mammals. The *corpora quadrigemina* form a much smaller mass of the brain than in the lower vertebrates, are not hollow internally, and in many are covered by the hemispheres of the brain. Also the cerebrum forms many convolutions (*gyri*) on its surface; although there are many mammals in which the surface is smooth, as it is in the brain of the oviparous vertebrates. The weight of the brain is to that of the whole body in the ox as 1 : 750 or 1 : 850, in the elephant as 1 : 500, in the sheep as 1 : 350, in the fox as 1 : 205; the relative weight of the brain is greater in small animal species; in the mouse, for instance, it is stated to be $\frac{1}{13}$ of the weight of the whole body[2]. In man the proportion is as 1 : 40[3]. Of more interest is the relation of the cerebral mass to the size of the cerebral nerves, and the comparison between the greatest breadth of the brain and the breadth of the spinal cord, behind the *bridge of Varolius*. The breadth of the spinal marrow thus estimated is to that of the brain in man, for example, as 1 : 7, in the dog as 1 : 2, &c.[4]

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[1] R. OWEN *On the structure of the Brain in Marsupial Animals; Philos. Transact.* 1837, Part I. pp. 87—96, Pl. 5—7.

[2] Compare on these relations HALLER *Elem. Physiol.* IV. pp. 6, 7; CUVIER *Leç. d'Anat. comp.* II. pp. 149—151.

[3] The weight of the human brain amounts to between three and four pounds; see TIEDEMANN *Das Hirn des Negers, u. s. w.* Heidelberg, 1837, 4to, s. 6, 7.

[4] CUVIER *Leç. d'Anat. comp.* II. p. 154; J. G. EBEL *Observationes neurol. ex Anat. comp.* Traj. ad Viadr. 1788, 8vo. The proportion between the breadth of the *medulla oblongata* and that of the *pons Varolii* has also been investigated; in most mammals this last is not broader, or scarcely broader than the *medulla oblongata*. Compare F. TIEDEMANN *Icones cerebri simiarum et quorundam Mammalium*, Heidelbergæ, 1821, folio, p. 53, which work (with TREVIRANUS *Verm. Schr.* III. s. 4—20, and GRATIOLET in GUÉRIN *Revue et Magasin de Zool.* 1852, pp. 97—113, Pl. 4—7,

The cerebral nerves correspond to those of man. The first pair, however, forms in some degree an exception, for though not indeed absent in all true *Cetacea*, it is wanting in the dolphins[1]. In most mammals (the apes alone with the seals and those cetaceans which possess olfactory nerves make an exception here) the olfactory nerves are thick and have a cavity internally, which is a prolongation of the lateral ventricles, just as the nerves also (*processus mamillares*) exhibit themselves as prolongations of the cerebrum. The fifth pair of nerves, forming principally the nerves of sensation for the head, and sending branches to all the organs of sense, is in many mammals of peculiar strength and thickness when compared with that pair in man[2].

The nervous system of organic life, the great sympathetic, is formed, as far as investigations indicate, essentially as in man. This system is situated in great part in the cavities of the thorax and abdomen, and follows the course of the vessels. The largest plexus (*plexus cœliacus s. solaris*) lies behind the stomach, principally round the *cœliac* artery. The great sympathetic is connected by many branches and in various situations with the nervous system of animal life, in part supplying and in part receiving the nervous filaments[3]. The spinal nerves are connected both by their anterior (inferior or motor) roots, and by their posterior

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on the convolutions of the cerebrum) may be consulted with advantage on the brain of mammals. The mammals have in general behind the pons on each side a small transverse band of fibres at the origin of the seventh and eighth pair; this part, which TREVIRANUS names *trapezium*, is absent in man (but not in the apes). The lateral ventricals of the brain have, with the exception of the apes and some others, no posterior horn, and thus also no *pes Hippocampi minor*. TREVIR. *Verm. Schr.* III. s. 4, 5.

[1] STANNIUS *Ueber den Bau des Delphin-Gehirns; Abhandlungen herausgegeb. von dem naturwissenschaftlichen Verein in Hamburg*, I. 1846; see especially s. 4, and Tab. II. base of the brain. In *Hyperoodon*, on the other hand, ESCHRICHT has described and figured the first pair of nerves. *Kongel. Danske Videnskabernes Selskabs Naturvidensk. Afhandlinger*, XI. 1845, p. 360, Tab. VIII. In *Balæna* OWEN describes these nerves as not dissimilar to those of man; HUNTER *Animal Œconomy*, pp. 367, 368.

[2] Compare W. RAPP *Die Verrichtungen des fünften Hirnnerven-Paares*, Leipzig, 1832, 4to. For the comparative anatomy of the cerebral nerves in mammals there are several important contributions by and under the guidance of Prof. BONSDORFF of Helsingfors, and amongst them, in the dog, the first six pairs of nerves by V. HARTMANN (1846), and the last six pairs by PIPPING (1847), described in two (Swedish) dissertations defended at the University.

[3] See amongst others F. ARNOLD *Der Kopftheil des vegetativen Nerven-Systems beim Menschen*, Heidelberg u. Leipzig, 1831, 4to.

(superior or sensitive) roots with the sympathetic nerve, as the investigations of WUTZER, MUELLER, RETZIUS, and MAYER have demonstrated[1].

The skin of mammals is covered with hair as the rule; some have horny scales as *Manis*, or bony plates as the armadillos (the genus *Dasypus*[2]), or spines (*Erinaceus*, *Hystrix*, *Tachyglossus*, &c.[3]). The sense of touch is variously developed in the extremities of the limbs in the different species, according as the feet serve only for progression and standing, or for seizing also. In the apes, which in this respect are the most privileged, the hand is indeed much less adapted for feeling than in man, who in his erect posture and gait can move and apply his fore limbs for the sense of touch more commodiously. The whiskers which are attached to the lips, serve, like the fleshy appendages at the jaws of some fishes (see above, p. 46), to give warning of external obstacles. Branches of the fifth pair of nerves are distributed to their roots. Cats are rendered unable to catch mice when these whiskers are removed, and various experiments have shewn, that rabbits without the assistance of their eyes can by means of these hairs find an outlet in narrow passages[4]. Similarly, the membrane, richly supplied with nerves, which is extended between the fingers of the hand in the bats, serves for the avoidance of external obstacles during flight, whilst the experiments of SPALLANZANI have shewn that neither smell, nor sight, nor hearing are necessary for this.

Taste is more highly developed in mammals than in the rest of the vertebrate animals. The tongue is fleshy, consists of many muscles which mutually decussate, and thus are able to effect a great variety of motion. We may here conveniently describe the bony apparatus to which the tongue with its various muscles is

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[1] See RETZIUS, MECKEL'S *Archiv*, 1832, s. 260, 261, with a figure of the connexion of the tenth spinal nerve with the sympathetic in the horse, Tab. I, fig. 10; WUTZER in MUELLER'S *Archiv*, 1834, s. 305—310.

[2] Compare H. MEYER *Ueber den Bau der Haut des Gürtelthiers*, MUELLER'S *Archiv*, 1848, s. 226—232. True bony plates are situated in the *corium*, which forms under them a very thin layer only; horny scales are situated in the epidermis.

[3] See F. CUVIER *Recherches sur les épines du porc-épic*, *Nouv. Annales du Mus.* I. 1832, pp. 409—439; C. J. A. BŒCKH. *De spinis Hystricum Dissertatio*, Berolini, 1834, 4to.

[4] G. VROLIK *Over het nut der knevels bij viervoetige dieren*, Amsterdam, 1800, 8vo.

attached. This apparatus consists of a transverse middle piece (*basis*), uneven and convex in front, mostly excavated behind, and usually of two pairs of lateral pieces, the so-named horns, of which the posterior pair in the rats and some other rodents, and in the graminivorous cetaceans is absent. The anterior horns (in man the smallest, *cornua minora*) are always connected with the temporal bone by cartilages or ligaments[1]. Here are situated in most mammals two or three long, sometimes round, sometimes flat bones (*ossa styloidea*), whilst in man a styloïd process in connexion with the temporal bone forms the upper part of the junction. The posterior horns (*cornua majora*) extend backwards and from each other, and are united by ligaments with the thyroïd cartilage of the larynx. In *Mycetes* (*Simia seniculus*) the basis expands to form a bony vesicle. In the horse, from the anterior part of the arch formed by the middle piece a stiliform process extends, which penetrates the root of the tongue. Different muscles, which run from the sternum, the scapula, the temporal bone, and the lower jaw to the tongue-bone, move it and the tongue with it. Three nerves are distributed to the tongue. The *hypoglossal* nerve is a motor nerve, and supplies principally the muscles of the tongue; the *glossopharyngeal* nerve, common to the tongue and pharynx, goes partly to the posterior portion of the tongue, and sends branches to the papillæ seated there, where chiefly the peculiar impression of taste seems to be produced; the nerve of feeling of the tongue is the *lingual* nerve, which arises from the third branch of the fifth pair[2]. The lingual papillæ are divided into *filiform*, *conical*, *obtuse* (*papillæ fungiformes*) and *stemmed* (*papillæ vallatæ*), the last of which are surrounded by a circular groove, and are larger than the others; they occur upon the posterior part of the tongue alone; their number is always small, and their arrangement differs in different genera of mammals. In some, as for example the genus *Felis*, the conical papillæ are covered by a horny investment.

The olfactory organ differs from that of other vertebrates both in the cribriform lamina of the ethmoïd, of which the apertures

[1] See note, p. 572.

[2] According to PANIZZA the *nervus glossopharyngeus* is a nerve of taste, the *nervus lingualis* exclusively a nerve of feeling; see also STANNIUS in MUELLER'S *Archiv*, 1848, s. 132—138. MUELLER and others, on the contrary, are of opinion that the last-named nerve, although chiefly serving for feeling and touch, includes also nervous filaments for taste.

transmit the branches of the first pair of nerves to the nasal cavity[1], and in the sinuses, subsidiary cavities, usually divided into mutually communicating cells, which exist in the frontal and sphenoïd bones and the superior maxillary bones. The mucous membrane that covers these cavities is thinner than that of the nasal cavities, and receives no branches from the first pair of nerves[2]. Although they cannot themselves be the seat of smell, still they have the greatest extent in those mammals whose sense of smell is most acute. All mammals do not, like man, possess these three different cavities simultaneously. In the edentates, for instance, the frontal sinuses are wanting; those in the sphenoïd bone are commonly much smaller than in man. The largest frontal sinuses occur in the elephant, in which they not only extend to the parietal and temporal bones, but even to the articular condyles of the occipital bone. The bony parts of the nasal cavities are further completed by cartilages, which in some mammals form a case, or are prolonged into a moveable snout as, for example, in the hog, the mole, &c. Above all, the proboscis or trunk of the elephant is remarkable, which contains two such tubes in the interior, that extend throughout the whole length of the organ. Thick nervous branches are distributed to the proboscis which arise from the suborbital nerve of the second branch of the fifth pair. Many muscular bundles, of which the innermost run transversely and pass by their tendons between the exterior longitudinal fibres to the skin, give motion to the trunk[3]. In the true cetaceans there are no accessory cavities in the cranial bones in connexion with the nasal cavity. The nasal cavity ascends nearly in a straight direction to the upper part of the cranium, where the external double or single nasal aperture (the so-named blow-holes) are situated. Near these apertures on the upper part of the cranium are two sacs covered by mucous membrane, folded longitudinally and of a black colour, which is regarded as the olfactory organ of these animals, but which receives its nerves from the ophthalmic branch of the fifth pair only[4].

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[1] Compare above, p. 570, as also on the *conchæ*.

[2] Compare BLUMENBACH *Prolusio acad. de sinibus frontalibus*, Gottingæ, 1778, 4to.

[3] CUVIER *Leç. d'Anat. comp.* II. pp. 665—667, and especially V. pp. 283—289; comp. *ibid* Pl. XXIX.

[4] CAMPER *Cétacés*, pp. 148—150, Pl. 48, fig. 1; G. SANDIFORT *Bijdragen tot de ontleedkundige kennis der walvisschen*, cited above, see p. 587.

With the nasal cavity is connected in different mammals, especially the ruminants and rodents, an organ discovered by the Danish anatomist JACOBSON, and through which a closer connection perhaps is established between taste and smell. It consists of two longitudinal sacs, of which one is placed on each side of the cartilaginous septum of the nose, lying upon an excavation of that portion of the premaxillary by which the fore part of the palate is formed. These sacs, covered internally by a glandular mucous membrane, are surrounded by a cartilaginous sheath and usually communicate with a duct (formerly discovered by STENO), which runs through the *foramina incisiva* to the palate[1].

Eyes are always present in this class. In some, however, the sight is deficient, for the skin, without being fissured to form eyelids, passes in front of the eyeball, which in such instances is always very small (as in *Spalax, Mus typhlus*, PALL.[2]). The relative size of the eyes is on the whole less than in birds. The true whales have relatively (i.e. in proportion to their extraordinarily large body) very small eyes, although their eyes, regarded by themselves, are the largest in the whole animal kingdom. The eyeball commonly is almost spherical; the sclerotic coat is destitute of the support of a bony ring, which we remarked formerly in birds and different reptiles. In the true cetaceans the sclerotic is of remarkable thickness, from whence the cavity of this sense-organ is of still less size than that inferred from the small relative size of the eyeball. In man and the apes there is at the entrance of the optic nerve at the inside a yellow spot on the retina, which was first noticed by SŒMMERRING. In the dolphins, the greater number of carnivores and the ungulates, the choroïd coat is for a space at the back part of the eyeball destitute of the black colouring-matter which is elsewhere dispersed over it, and its place is

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[1] Compare CUVIER *Rapport fait à l'Institut, Ann. du Muséum*, XVIII. 1811, pp. 412—424; ROSENTHAL in TIEDEMANN *u.* TREVIRANUS *Zeitschr. für Physiol.* II. 2, 1827, s. 289—300, with a figure of this part in the sheep. In the horse also it is present, but there is no duct running to the palate. In man this organ is absent, but the duct (at least often) is present. The duct itself, according to a remark of HUSCHKE, is of no physiological significance, but is merely a vestige of a fœtal state, in which the cavities of the mouth and nose were in connexion through the entirely fissured palate. *Lehre von den Eingeweiden*, s. 612.

[2] Compare on the eyes of this animal RUDOLPHI *Physiol.* II. 1, s. 157, Anm. 1.

occupied by a fibrous or cellular membrane, named *tapetum*, which often presents lively colours with metallic reflections[1]. The lens is commonly flat and is bounded posteriorly by a more convex surface than in front. In the mammals that live in water, especially in the seals (*Phocæ*), it is nearly spherical. As a rule there are three eyelids present; but in man and the apes there is only a vestige of the innermost perpendicular eyelid (the *membrana nictitans*), the so-named semilunar fold at the inner angle of the eye[2].

The auditory organ of mammals differs from that of birds by the labyrinth being more strictly included in the petrous portion of the temporal bone, by a greater development of the cochlea (usually forming two and a half or three spiral turns), and by three auditory ossicles, the *malleus*, the *incus*, and the *stapes*, which conduct the vibrations of the tympanic membrane to the vestibule, on the fenestra ovalis of which the plate of the stapes rests. This stapes is in the Monotremes a long stile with a flattened base, like the columella in birds; the transition to this is formed by the marsupiate and some edentate animals, where the two branches of the stapes do not diverge, or diverge only when close to the terminal plate, and in addition the ossicle terminates in a long stile. The Monotremes also have only one ossicle in place of the malleus and incus, and a very imperfect cochlea, which, as a conical appendage of the vestibule somewhat swollen at the extremity, resembles that of the birds and lacertians[3]. Generally an external ear also is

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[1] Compare BRUECKE in MUELLER'S *Archiv*, 1845, s. 387—405.

[2] Compare BLUMENTHAL *Dissert. de externis oculor. integumentis*, Berolini, 1812, 4to; TRAPP *Symbolæ ad anat. et physiol. Organorum bulbum adjuvantium*, Turici, 1836, 4to (pp. 26—31, especially for the *membrana nictitans* and the included cartilage). In most mammals with the *membrana nictitans* there occurs also a peculiar gland (*Glandula Harderi*, see above, pp. 232, 367), which we have already noticed in the reptiles and birds. The lachrymal glands are often small; in the cetaceans they seem to be wanting, but in the dolphins a ring-shaped gland behind the eye-lids is present (RAPP *Cetaceen*, s. 93). Besides the four straight and the two oblique muscles of the eye there is in many mammals another running from the margin of the *optic foramen* to the bulb of the eye, and forming that conical muscle which grasps it (*musculus suspensorius oculi*); in the *Balænæ* (according to MAYER *Anat. Untersuchungen über das Auge der Cetaceen*, Bonn, 1852, 8vo, s. 2) in the absence of the other muscles of the eye it only is present.

[3] *Tachyglossus*, according to the investigations of HYRTL, is even destitute of *fenestra rotunda*.

present. This organ is however wanting in the Monotremes, the Cetaceans, many seals, the mole, &c. In the true whales the external auditory aperture is a capillary passage[1].

The motions of mammals consist principally in progressing; some are able to spring very well, others are formed for swimming. In the true cetaceans, swimming is the sole motion; some mammals are able to fly by the assistance of a membrane extended between the much elongated fingers of the fore limbs (the bats); others flutter, or avail themselves in springing of a parachute, formed by a prolongation of the skin along the sides of the body between the fore and hind limbs (*Galeopithecus*, *Pteromys*, *Petaurista*).

The regenerative power in mammals is small. Their intellectual power is more developed than that of any other animals; many domestic animals are exceedingly docile, and thus are able to perform important services for man. Hence the mammals stand in close relation to the history of mankind; the exercise on the part of man of his mastery over those animals which could be of service to him, was one of the first efforts he was obliged to make in order to lay a foundation for the further development of civilization. The dog at an early period had been his companion; different hoofed animals formed in his pastoral life his principal possession, or his beasts of burden, which alleviated his necessary labour in cultivating the land.

Various is the abode (the physical distribution) of mammals. Some reside entirely in the sea, as the cetaceans and most of the seals (*Phocæ*), although some species, especially of the animals last named, live in fresh water. Many species of the genus *Sorex*, the otters, beavers, the duck-mole, reside in lakes and rivers. Other mammals live under ground (*Talpa*, *Bathyergus*, &c.). The most however live on land, some on high mountain tops (as *Antilope rupicapra*, *Capra Ibex*), others on trees (most of the apes and squirrels, the sloths), and some resort, by flying or flapping, in

[1] Compare on the auditory apparatus of mammals, besides the general works of comparative anatomy, E. HAGENBACH *Disquisitiones anat. circa musculos auris internæ Hominis et Mammalium*, Basiliæ, 1834, 4to; by the same, *Die Paukenhöhle der Säugethiere*, Leipzig, 1835, 4to, and the eminent monography of J. HYRTL *Vergleichend-anatomische Untersuchungen über das innere Gehör-Organ des Menschen und der Säugethiere*. Mit 9 Kupfertafeln. Prag, 1845, 4to.

part even to the air (*Galeopithecus*, the *Chiroptera*). This difference of resort is naturally in relation with the general bodily form and the constitution of its different parts, especially of the organs of motion and of sense. Thus, for example, the limbs are changed into fins in the whales, or are provided with a membrane for swimming in most of the other water-animals; the eyes are small in those animals that burrow under ground; the external ear is small, or is absent in these last, as well as in those mammals that live constantly in water.

In the geographic distribution of the mammals in the first place the general law again receives confirmation, that the number as well of genera as of species increases from the poles to the equator. Still, however, the true cetaceans and the seals must be excepted from it, for to them the same rule applies as to the swimming-birds, of which the species are more numerous in the polar regions. There are species in the north polar regions common to the old and the new world, as *Canis Lagopus*, *Ursus maritimus* and *Cervus Tarandus;* without the polar circle also some species are found in the northern countries of both hemispheres, as *Mustela Martes* and *Mustela erminea* and *Castor Fiber*. (Some writers indeed maintain that the beaver of America is specifically different from that of the old world.) In the temperate parts of North America almost all the species are such as do not occur in the eastern hemisphere; in South America no single species is found which also lives in the old world, nay, even the genera differ for the most part from those of the old world. South American genera, of which no species in the old world are hitherto known, are the following: *Dicotyles*, *Auchenia*, *Dasypus*, *Myrmecophaga*, *Bradypus*, *Cavia* (or the genera of more modern writers *Cœlogenys*, *Dasyprocta*, *Hydrochœrus*), *Loncheres*, *Nasua*, the genera of the bat-tribe: *Glossophaga*, *Phyllostoma*, *Molossus*, *Noctilio*, and many genera of quadrumanes, namely *Callithrix*, *Ateles*, *Mycetes*, *Pithecia*, *Hapale*. *Procyon* is peculiar to the new world in the northern and southern hemispheres. *Fiber* is an animal form of North America. Other genera are peculiar to the eastern hemisphere, as *Sus*, *Equus*, *Camelus*, *Rhinoceros*, *Manis*, *Myoxus*, *Spalax*, *Cricetus*, *Viverra*, *Herpestes*, *Erinaceus*, the genera of bats: *Megaderma*, *Nycteris*, *Rhinolophus*, *Pteropus*, the family of the Lemurids, the genera of the apes: *Cercopithecus*, *Semnopithecus*, *Inuus*, *Cynocephalus*, *Hylo-*

bates, *Simia*. To Africa in particular are peculiar the genera *Camelopardalis*, *Hippopotamus*, *Orycteropus*, *Cercopithecus*, and to the Island Madagascar *Centetes*, *Lemur*, *Lichanotus*, and the genus *Chiromys*, a sciurean rodent, which approaches the Lemurids in form. Most of the species of Antilopes are also exclusively African. The greatest number of species of Marsupials is found in New Holland; the genus *Didelphys* alone is American; Africa, as well as Europe, does not possess a single species of this division. The Monotremes (the genera *Ornithorhynchus* and *Tachyglossus*) are peculiar to New Holland. In New Holland, on the other hand, as to genera that are dispersed nearly over the whole of the rest of the world (as *Cervus*, *Sciurus*, *Lepus*, *Felis*, *Ursus*, *Lutra*, *Canis*, *Vespertilio*) of a few only a single species occurs, of the most absolutely none. The Marsupials, of which all the species scarcely form one-fifteenth of all the land-mammals in the world, form three-fourths of the mammalian fauna of New Holland. On the whole, the statistics, so to speak, of the mammalian families in different countries and climates present great differences. If we take into consideration the entire class of mammals, exclusive of the Cetaceans and *Phocæ*, then the rodents form one-third of the entire number of species, the cheiropters and carnivores together about one-third also, whilst the remaining third is formed, for the greater part, of the Quadrumanes and Ruminants, and especially of the Marsupials and insectivorous *ferœ*[1]. But in Europe, for instance, this proportion is greatly modified, since the marsupiates and quadrumanous animals are absent; the proportion of rodents remains nearly the same; the cheiropters also form about one-sixth of the entire number; but the insectivorous feræ are in Europe nearly twice more numerous than when the whole are taken into account, and form one-thirteenth of the entire number of the mammals; the species also of *carnivora* and ruminant animals are proportionally much more numerous. In North America the species of rodents form perhaps half the entire number of the species of land-mammals. How different again is the proportion which prevails within the tropics may be readily inferred. For to these countries, or at least to the warmer districts, nearly all the genera

[1] Want of space precludes a detail of the grounds of these estimates. The remaining orders, however, contain very few species as compared with the whole number.

of the pachyderms, the edentates, and the apes belong. The apes indeed, with respect to their distribution, have been compared to the parrots amongst birds; but here this great difference is observable, that of the species of apes occurring in the old world, the largest half belongs to Africa, whilst Africa possesses very few species of parrots as compared with Asia. In New Holland also there are no apes, where various species of *Psittacus* occur. Insectivorous mammals, with the exception of the genus *Chrysochloris*, are a form almost peculiar to the northern hemisphere; the Lemurids more to the southern hemisphere. From a more careful comparison a greater number still of such contrasts would be deduced. The connexion also should not be forgotten which prevails between the distribution of plants and animals; and as in the vegetable kingdom, so also in the animal, of those genera which in cold districts have numerous species, the species occurring in warm countries are found more on mountains than on plains[1].

With the exception of some species of bats and of the true whales, mammals are not tied, like birds of passage, to make strictly limited migrations, but inhabit the same districts in winter and summer alike[2]. On the other hand, different species hibernate, and pass a greater or less portion of the year without food in caves and hiding-places. Amongst such in Europe are, for example, the bats; the hedgehog, the hamster, the marmot, and various other species of rodents forming the genus *Myoxus*, and in the north, the bears. (Just as the same species of birds in cold countries migrate, and in warm countries remain for the whole year, so also the phenomenon

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[1] On this subject may be compared J. A. G. ZIMMERMANN *Specimen Geographiæ Quadrupedum*, L. B. 1777, 4to (antiquated); TREVIRANUS *Biologie*, II. s. 174—263, in different places; ILLIGER *Ueberblick der Säugethiere nach ihrer Vertheilung über die Welttheile. Abh. der Königl. Akad. der Wissensch. zu Berlin*, I. 1815, s. 39—159; WILBRAND *und* RITGEN *Gemälde der organ. Natur*, s. 69—88; E. K. SCHMARDA *Die geographische Verbreitung der Thiere*, Wien, 1853, 8vo (compiled with great literary knowledge).

[2] It would seem, however, from some observations, that certain species of bats migrate; see GLOGER in OKEN'S *Isis*, Bd. 21, 1828, s. 1113—1124, BRASIUS *Amtlicher Bericht über die Versammlung zu Braunschweig*, 1841, s. 63. The whales, which pass the summer in the polar regions, voyage southwards in winter into the Atlantic Ocean; some species follow probably the numerous shoals of fishes, for greater abundance of food. Compare ESCHRICHT *Untersuchungen über die nordischen Wallthiere*, s. 6—10, and in other places.

of hybernation varies in some degree according to climate in the same species of mammals.) These animals before beginning their winter's sleep are particularly fat; when in the spring they again emerge from their secret places they are much emaciated. The respiration is interrupted by long intervals and is nearly suspended; the quantity of oxygen consumed during this state is very small. Animal warmth is much diminished; and the temperature of the internal parts falls to 7°, 6°, or even 3° of the centigrade scale; it appears to depend upon that of the surrounding air. The beats of the heart are much less numerous; the circulation, however, of the blood, though much retarded, proceeds uninterruptedly in the capillaries. During the complete hybernation the feeling is almost entirely suspended; particular portions of the body retain their irritability long after death. Hence it would seem that they are not altogether in the wrong who maintain that the life of mammals during hybernation sinks down into that of reptiles. On the cause of this phenomenon various opinions have been offered, of which some rest upon incorrect observations, others upon undemonstrated assumptions, and others again upon no foundation at all. That, for example, the bile of these animals is less acrid, and that on this account they can support hunger for a longer time, as SAISSY maintains, is an assumption without proof; that the *thymus* gland during hybernation increases in bulk and compresses the lungs, as PRUNELLE believes, is a contested point, whilst (according to JACOBSON) it is not that gland but a mass remarkable for the quantity of fat which penetrates it and oppresses the thorax; as little can the course of an artery through the *stapes* (which OTTO discovered, and held to be the cerebral carotid[1]) elucidate the phenomenon, for the same distribution occurs also in species not subject to winter-sleep. Whether the pulmonary cells be larger and the capillaries of the lungs less fine, than in other mammals (BARKOW), seems to require confirmation. Thus do we abstain from further record, comparison, or refutation of different opinions. The essence of hybernation consists in temporary depression of the powers of life from almost entire suspension of respiration. This is almost all that can be said upon the subject. That the tanrec, the hedgehog of Madagascar (*Centetes* ILLIG.), sleeps at the hottest time of the

[1] According to HYRTL this artery is rather an *arteria orbito-maxillaris*.

year (summer-sleep) as BRUGUIÈRE asserted, was afterwards contradicted by DESJARDINS, according to whom, on the contrary, this animal, when it is summer with us, and thus during the winter season of that island, falls into its periodic sleep[1].

The arrangement of mammals, derived by RAY and KLEIN chiefly from the digits and nails, by LINNÆUS from the teeth, was improved by STORR, CUVIER and others, and advanced to greater perfection especially by the physiological and embryological views of OWEN.

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[1] At the island Mauritius from June to November, *Ann. des Sc. nat.* XX. p. 180, according to TALFAIR from April to November, *Proceedings of the Zool. Soc.* I. 1830, p. 89; the temperature, however, does not need to fall to 20° centigr.; they sometimes sleep even at 26°. *Ann. des Sc. nat.*, Seconde Série, II. p. 316.

On hybernation may be compared G. MANGILI, J. A. SAISSY, PRUNELLE, J. F. BERGER, PASTRÉ and others cited in the first edition of my handbook, to which I now add: OTTO *De Animalium per hyemem dormientium vasis cephalicis, Nov. Act. Acad. Cæsar. Leopold. Carol.* Tom. II. MARSHALL HALL *on Hybernation, Phil. Trans.* 1832, Part 2, pp. 335—360, the same in TODD'S *Cyclopæd.* II. pp. 764—776, and H. C. L. BARKOW *Der Winterschlaf nach seinen Erscheinungen im Thierreich*, Berlin, 1846, 8vo, in which last work may be found the fullest account of the entire literature on this subject.

SYSTEMATIC

ARRANGEMENT OF MAMMALS.

CLASS XVII.

MAMMALIA.

VERTEBRATE animals, breathing atmospheric air by lungs; with red, warm blood; heart with two auricles and two ventricles, viviparous, lactating, furnished with a muscular diaphragm, covered by skin mostly hairy, armed more rarely with spines, sometimes partly mailed by scutes.

SECTION I. *Mammalia acotyledona s. implacentalia; Lyencéphala* OWEN. Uterus double. Placental conjunction between mother and embryo none.

Corpus callosum of brain indistinct. Two marsupial bones in front of symphysis of pubic bones. Four feet in all.

ORDER I. *Monotremata.*

Cloaca, receiving the outlets of the rectum and the urethro-genital canal. Two clavicles, a coracoïd and a furcular. External ears none. Teeth corneous or none. Hind feet in males furnished with a perforate spur.

Family I. *Monotremata.* (Characters of the order those of the single family also.) Feet short, pentadactylous. Snout produced, covered with naked, coriaceous skin.

Monotremata, from μόνος sole, single, and τρῆμα opening, in allusion to the single cloacal aperture for the urinary and intestinal excretions, and for the outlets of the sexual passages. Compare on this order DUCROTAY DE BLAINVILLE *Dissertation sur la place des Ornithorhynques et des Echidnés dans les séries naturelles*, Paris, 1812, 4to, and especially OWEN in TODD'S *Cyclopæd.* III. pp. 366—407.

SECTION I. *Dermatopoda.* Feet palmate.

Ornithorhynchus BLUMENB., *Platypus* SHAW, *Dermipus* WIEDEM. Eight horny teeth $\left(\frac{2-2}{2-2}\right)$ flat, destitute of fangs, composed of perpendicular horny tubules, the anterior narrow, long, the posterior oval. Snout depressed, flat, broad; lower jaw narrower, shorter, marked at the margin posteriorly by several transverse striæ. Body hairy. Tail broad, depressed, beset with rigid hairs.

The *duck-billed animal,* the *water-mole* of the English colonists. On the structure of the organs of propagation we have already spoken. The sternum consists of four flat bony pieces placed one behind another, to which the ribs are attached, and of a larger piece lying in front of these, which has in some degree the form of an hour-glass, but in front terminates in two transverse branches, on the anterior margin of which the furcular clavicles are situated, and soon coalesce with them. The scapula forms, with the other clavicle, the coracoïd clavicle, the articular cavity for the humerus. The coracoïd clavicle descends obliquely from the articular cavity to the lowest part of the lateral margin of the first and the anterior part of the second sternal piece; in front of it, and along the sides of the first sternal piece is another bony plate, to which MECKEL gave the name of *Clavicula coracoidea anterior,* the *os epicoracoideum.* These two anterior bony plates meet in the mid-plane and are covered below by the sternum. Such also is the structure in the following genus *Tachyglossus.* The pelvis is formed after the mammalian type.

The spur of the male consists of a conical and perforate bony piece, covered by a horny investment, through which runs the excretory duct of a gland situated on the thigh; some observations, from which it had been concluded, that the fluid secreted by this gland was possessed of venomous properties, and that the spur was used by the animal as an offensive weapon, have not been subsequently confirmed; perhaps it has relation to copulation. MECKEL found in the female water-mole a small cavity in the same situation which appeared to be adapted for the reception of the spur.

The water-moles live in the rivers and lakes of New Holland and of Van Diemen's Land. They dive and swim like water-birds and secure their prey, whilst swimming, with their bill, as ducks do. They feed on worms and insects; fragments of shell and parts of water-insects have been found in their cheek-pouches and in their stomach. They dig holes of twenty or more feet long, which have a double entrance, one close above the water and another below the water, and ending in a larger space covered with rushes and other dry plants. The young animal is naked, and has a short beak with flexible jaws. The adults attain a length of from seventeen to twenty-two inches, from the anterior margin of the upper jaw to the point of the tail, which is about five inches long.

Sp. *Ornithorhynchus paradoxus* BLUMENB., *Abb. naturh. Gegenst.* 41, SCHREB. Tab. 63 B, GUÉR. *Iconogr., Mammif.* Pl. 36, fig. 2, CUV. *R. Anî., éd. ill.,*

Mammif. Pl. 75, fig. 2. PÉRON admits two species: *Ornithorhynchus rufus* and *Ornith. fuscus, Voyage de découv., Atl.* Pl. XXXIV. (these figures are badly coloured). In my youth I undertook the defence of this opinion and gave figures from stuffed specimens, *Nov. Act. Acad. Cæs. Leop. Carol.* XI. 2, 1823, pp. 351—372, Tab. 47; I now attach no importance to them, since the unanimous opinion of travellers is against it. Some individuals are more ruddy-brown; others, especially the larger, are dark-brown on the back; the under surface is grey.

Compare on the anatomy HOME *Philos. Trans.*, 1802, pp. 67—84, Pl. 2—4, 1819, pp. 234—241 (also in his *Lectures on comp. Anat.*), the classical work of J. F. MECKEL *Ornithorhynchi paradoxi descriptio anatomica*, Lipsiæ, 1826 fol., OWEN *Phil. Trans.* 1822, P. 2, pp. 517—538, 1834, P. 2, pp. 555—566, &c. and in TODD'S *Cyclop.* Article *Monotremata*, III. pp. 366—407. The young animal is described and figured by him in *Trans. of the Zool. Soc.* Vol. I. 3, 1835, pp. 221—228. On the mode of life and the economy BENNETT has given an interesting paper, *ibid.* pp. 229—258. See also the observations of VERREAUX, *Revue Zoolog.* 1848, pp. 127—134, which for the most part correspond with those of BENNETT.

SECTION II. *Orygopoda s. Tachyglossa.*

Feet fossorial, not palmate.

Tachyglossus ILLIG., *Echidna* CUV.[1] (Spec. of *Ornithorhynchus* HOME.) Teeth none. Snout subulate, somewhat depressed, with gape of mouth at the apex small. Tongue round, long, exsertile. Body covered with hairs and spines. Claws large, the second and third of hind feet very long, falciform. Tail very short, truncate at the apex.

Sp. *Tachyglossus aculeatus* ILLIG., SCHREB. II. Tab. 63 B., *Myrmecophaga aculeata* SHAW *Natur. Miscellany*, Vol. III. Pl. 109, *Ornithorhynchus Hystrix* HOME *Philos. Trans.* 1802, Pl. 10, WATERHOUSE *Mamm.* I. p. 41; New Holland.—*Tachyglossus setosus, Echidna setosa* CUV., *Echidna breviaculeata* TIEDEM., HOME l. l. Tab. 63 *c*; Van Diemen's Land. (This species or local variety has longer hairs and shorter spines on the back.) These animals burrow under ground, live on ants and other insects, and are, even more than the *Ornithorhynchus*, nocturnal animals. They attain a length of fourteen to seventeen inches. Compare HOME l. l. A figure of the skeleton is to be found in MECKEL'S *Beitr. zur vergl. Anat.* I. 2, Tab. 9, in CUVIER *Rech. s. les Ossem. foss.* V. 1, Pl. 13, and in PANDER *und* D'ALTON *Skelete der zahnl. Thiere*, Tab. 3. The brain is figured and described by LAURENT in GUÉRIN *Magas. de Zool.* 1838, Cl. I, pp. 141—152, Pl. 30. The cerebrum

[1] *Tableau élément*, 1798, p. 143; ἔχιδνα, the same as ἔχις, is a species of snake or adder. I cannot suppose that CUVIER had this in his mind, but rather ἐχῖνος, hedgehog, as indeed his addition *fourmilier épineux* indicates. The name, therefore, to have any meaning, must be modified. Hence *Tachyglossus* is to be preferred.

has convolutions, which in the *Ornithorhynchus* are absent. The olfactory nerves are unusually developed.

Order II. *Marsupialia.*

Mammæ ventral, contained in the pouch or placed between two oblong, cutaneous folds. Clavicle single (furcular) perfect in almost all, coracoïd clavicle none. Incisor and molar teeth in all. External ears in all.

Marsupial animals. Linnæus united in a single genus the species known to him, under the name *Didelphis* (*didelphis* from δελφύς, *uterus*), because the pouch in which the young are received, forms, as it were, a *second womb.*

Compare on the propagation of these remarkable animals Home *Phil. Trans.* 1808, pp. 307—312, Owen *Phil. Trans.* 1834, P. 2, pp. 333—364, on the osteology and the classification by the same, *Transact. of the Zool. Soc.* Vol. II. &c. See especially also his article *Marsupialia* in Todd's *Cyclopædia*, III. pp. 257—330. Many osteological peculiarities, especially in the cranium, are observable. The occipital bone in many species (*Opossum virginianum*, *Dasyurus ursinus* &c.) for the whole of life consists of four distinct pieces; the temporal bone commonly remains divided into three pieces. The great *ala* of the sphenoïd forms an expansion (*bulla*) similar to that formed in other mammals by the temporal bone. The bony palate has, in addition to the *foramina incisiva*, apertures of greater or less size closed by membrane. The inferior margin of the lower jaw is convex and broad, as if bent inwards, especially at the angle; this last is also observed in *Ornithorhynchus*. Also the cavity of the cranium is very small, and the cranium, however various in different genera, is on the whole flatter above than in other mammals.

For the special knowledge of the mammals belonging to this order we possess, besides the first part of Waterhouse's *Nat. Hist. of the Mammalia*, a smaller work by the same writer, forming the eighth vol. of Jardine's *Naturalist's Library*, Edinburgh, 1841. See also *The Mammalia of Australia*, by J. Gould, London, 1845—1852, 4 parts, folio.

Family II. *Glirina* Wiegm., *Rhizophaga* Owen. Incisors $\frac{2}{2}$; a large interval between the incisors and molars, canines none. Feet pentadactylous, with pollex of hind feet short, unarmed.

Phascolomys Geoffr.[1] Teeth with roots indistinct, molars with

[1] *Ann. du Muséum*, II. (1803) pp. 364—367. The animal described by Collins (*Account of the English Colony of New South Wales*, London 1802, quoted by Waterhouse) does not differ from this; the number of teeth had been given incorrectly, which caused Illiger to form the genus *Amblotis* (*Prodromus*, p. 77), a genus to be discarded from the class of Mammals.

flat crowns. Dental formula i. $\frac{1-1}{1-1}$, p. $\frac{1-1}{1-1}$, m. $\frac{4-4}{4-4} = 24$. Claws strong, fossorial. Tail very short.

Sp. *Phascolomys fossor* WAGNER, *Phascolomys Wombat* PÉRON, DESM., PÉRON *et* LESUEUR, *Voyage de découv.*, Pl. 28, GUÉRIN *Icon.*, *Mammif.* Pl. 22, fig. 4, WATERH. *Nat. Lib.* Pl. 32; the cranium figured in CUVIER *R. Ani.*, Pl. 2, figs. 4—6, OWEN *Transact. of the Zool. Soc.* Vol. II. Pl. 71, fig. 6, the skeleton *ibid.* Pl. 68, the teeth in F. CUV. *Dents des Mammif.* Pl. 44. The *wombat* is from two to three feet long, the tail only half an inch. The animal is of a brown colour and in its air somewhat resembles a small bear; it lives in holes underground and is found in the south of New Holland and in Van Diemen's Land. A skull from the south of New Holland, investigated by OWEN, seemed to him to belong to another species, which he names *Phascolomys latifrons*, of which, as far as I know, no further accounts exist; see *Transact. Zool. Soc.* Vol. III. pp. 303—306, Pl. 37. Whilst the rest of the marsupiates have only thirteen or twelve ribs, the *wombat* possesses fifteen or (in the skeleton at Leyden) sixteen. Although the tail beyond the pelvis is short, there are nine or ten caudal vertebræ (or rather, if the three vertebræ between the two iliac bones be alone regarded as sacral vertebræ, even thirteen or fourteen). Remains also of a fossil species have been met with in caves in New Holland. In the neighbourhood of this fossil genus ought also to be placed the fossil genus *Diprotodon* OWEN, of which remains have been found in the same caves and in alluvial deposits. This animal almost attained the size of *Hippopotamus*. OWEN *Appendix to* MITCHELL'S *Three Expeditions into the interior of Australia*, 1830, 8vo, Vol. II. p. 362, *Report of the British Association* for 1844, p. 223.

Family III. *Macropoda s. Salientia*[1]. Six superior incisors, two large inferior, procumbent; canines either none or only in the upper jaw, approximate to the incisors; molars $\left(\frac{5-5}{5-5}\right)$ remote from the anterior teeth by a large interval; anterior molar with a compressed narrow crown; four remaining molars furnished with two transverse tubercles. Posterior feet longer than anterior, tetradactylous, with two inner toes slender, small, conjoined as far as the small claws. Tail long, haired, not voluble.

The *kangaroos* are animals from the eastern part of the southern hemisphere, of which as early as the beginning of the last century a species from the Aroe Islands, under the name of *Filander*, was described by DE BRUYN and VALENTIN (DE BRUYN *Reizen over Moskovien door Perzië en Indië*, Amsterdam, 1714, Pl. 213), but of which since the end of that century,

[1] Poëphaga (grass-eating) OWEN.

and especially in the last twenty years, many species have been discovered in New Holland and Van Diemen's Land. They live on grass and plants (some on leaves), and in some degree correspond to the ruminants and the hares amongst the placental mammals. In many species the males are disparately large in comparison to the females.

Compare J. GOULD *A Monograph of the Macropodidæ or family of Kangaroos;* 2 Parts, London, 1841, 1842 fol. Various *genera* have been adopted in this family. After an attentive investigation of the species known to me I am only able to adopt four, regarding the rest as subdivisions of inferior importance.

† *Upper canines none or small, deciduous. First molar tooth not grooved externally.*

Macropus SHAW, *Halmaturus* ILLIG. Dental formula $\frac{3-3}{1-1}$, c. $\frac{0-0}{0-0}$, p. $\frac{1-1}{1-1}$, m. $\frac{4-4}{4-4}=28$; the two middle incisors not longer than the rest, the outermost on each side broad. Ears long, oval. Claws of fore feet curved, compressed. Tail strong, haired, shorter than body. Hind feet far surpassing the fore feet.

Sp. *Macropus giganteus, Didelphis gigantea* SCHREB., *Macropus major* SHAW, SCHREB. *Säugeth.* Tab. 154, *Kangaroo* PHILLIP *Botany Bay,* Pl. 10, p. 106; WHITE *New South Wales,* Pl. 54, p. 272; CUV. *R. Ani., éd. ill., Mammif.* Pl. 52, fig. 1; GOULD, Pl. 1; the skeleton figured in PANDER *u.* D'ALTON *Die Skelete der Beutelthiere,* Tab. 1; the *large kangaroo;* the length amounts to four feet, without the tail, which is full three feet long; this kangaroo is the largest mammal of New Holland and Van Diemen's Land;—*Macropus laniger* QUOY *et* GAIM. *Dict. cl. d'Hist. nat., Atl.* Pl. 153, *Dict. univ. d'Hist. nat., Mammif.* Pl. 19, GOULD, Pl. 2, &c. Some species are about the size of a hare, and resemble this also in their fur (*Lagorchestes* GOULD, Sp. *Macropus fasciatus* PÉRON *Voy.* Pl. 27; GOULD *Mamm. of Austr.* Part II. Pl. 6, *Macropod.* II. Pl. 15).

Whilst grazing the kangaroos move on their fore feet, and as they proceed push forward the hind feet at intervals; they then appear as if they had a difficult and obstructed gait, but that impression vanishes as soon as they are pursued; then they move by wide leaps on their powerful hind legs; when they sit they rest on these and their muscular tail only.

†† *Upper canine teeth distinct. Anterior molar (late in place) in length nearly equalling the two following teeth, sculptured at the sides by vertical grooves.*

Hypsiprymnus ILLIG., WATERH., *Potorous* DESMAR[1]. Two

[1] *Nouv. Dictionn. d'Hist. nat.* Tome 24, 1804, *Tableau méth. des Mammif.* p. 20, *Bettongia (!)* GRAY.

upper middle incisors long, produced beyond the small lateral incisors. Ears oblong, rounded, small. Claws of fore feet compressed, curved, with the three middle ones longer, the outer and inner very small. Posterior feet far surpassing the anterior. Tail shorter than body, slender. (Nasal bones acuminate at the extremity, produced beyond the upper jaw.)

Sp. *Hypsiprymnus murinus* ILLIG., *Macropus minor* SHAW, WHITE *New South Wales*, Pl. 60, p. 286, WATERH. *Natur. Library*, T. 16; *Potoroo* or *Kangaroo Rat;* New South Wales (the skeleton figured in PANDER *u.* D'ALTON l. l. Tab. 3). The species of this genus are small. Some have long hairs at the end of the tail with which they can grasp grass and plants and drag them to their nest, as *Hypsiprymnus cuniculus* OGILBY, GOULD *Macr.* II. Pl. 14.

Dorcopsis SAL. MUELL. and SCHL. Two upper middle incisors longer than lateral. Ears oval, narrow, moderate. Head long, protracted, produced beyond the mouth. Claws of fore toes strong, somewhat flat. Hind feet far surpassing the fore feet. Tail shorter than body, rather thick, ringed with scales towards the apex, naked.

Sp. *Dorcopsis Brunii* (*Hypsiprymnus* previously) SAL. MUELLER and SCHLEG. *Natuurk. Verh. over Nederl. Overz. Bezittingen, Mamm.*. Pl. 21; New Guinea and perhaps the Aroe Islands, if this species be the same as the *Filander* of DE BRUYN, *Didelphis Brunii* GM. This animal is much larger than the Potoroos and resembles the smaller species of Kangaroos, with which, however, they are improperly united by WATERHOUSE. A figure of the skull has been published already by PALLAS, after a drawing of P. CAMPER. *Act. Acad. Petropol.* 1777, Tab. IX. fig. IV.

Dendrologus SAL. MUELL. Two upper middle incisors scarcely longer than the lateral. Ears oblong and rounded, moderate, hairy. Claws of fore feet curved, compressed, strong. Hind feet scarcely surpassing in size the fore feet, which are larger than common. Tail longer than body, thick, hairy.

Tree-kangaroos, animals of New Guinea having a much darker fur than most of the species of this family; they climb on trees. Two species are known: *Dendrologus ursinus* SAL. MUELLER l. l. Tab. 19;—*Dendrologus inustus* SAL. MUELLER ibid. Tab. 20.

Family IV. *Phalangistæ s. Carpophaga* OWEN. Incisors $\frac{6}{2}$; the two upper middle somewhat large, the lower large, procumbent; canines $\frac{1-1}{0-0}$ or $\frac{1-1}{1-1}$, molars mostly small, anterior false

molars various in number, true molars tuberculate, covered with enamel. Hind feet pentadactylous, with pollex apart and clawless, the two succeeding toes conjoined as far as the claws.

Phascolarctos BLAINV., *Lipurus* GOLDFUSS.[1] Dental formula $i.\frac{3-3}{1-1}$, $c.\frac{1-1}{0-0}$, $p.\frac{1-1}{1-1}$, $m.\frac{4-4}{4-4} = 30$; premolars and molars quadrituberculate. Toes of fore feet separated unto two sets, the one composed of the two inner, the other of the three outer toes. Tail none.

Sp. *Phascolarctos cinereus, Phascolarctos fuscus.* DESMAR., *Lipurus cinereus* SCHREB. *Säugeth.* Tab. 155 A, (*Ab*, the skull and feet), CUV. *R. Ani.* Pl. 1, fig. 5; GUÉR. *Iconogr., Mamm.* Pl. 22, fig. 3, WATERH. *Nat. Libr.* Pl. 31, *Mamm.* I. Pl. 9, fig. 2; the *koala*, an inert animal from the east of New Holland, which climbs on trees and lives on the young shoots and leaves; it attains a length of nearly 2'.

Phalangista CUV. Small molars, variable in number, deciduous, not permanent, occupying the space between the canines and larger molars; mostly the larger molars $\frac{5-5}{5-5}$. Canines $\frac{1-1}{1-1}$, the inferior canines very small, contiguous to the incisors. Claws compressed, curved. Tail long.

Compare on this genus TEMMINCK, *Monogr. de Mammal.* I. pp. 1—20. All the species are met with on the islands of the Indian Archipelago, at New Guinea and New Holland. They are dull animals that sleep by day and hide amongst the leaves of trees. They eat all kinds of food, but principally fruits. A secretion from glands in the neighbourhood of the *anus* gives an unpleasant odour to the animals; yet the flesh of some species is eatable. In many species of this genus the canine tooth of the upper jaw, as in *Hypsiprymnus*, is inserted partly in the inter-maxillary bone. The small teeth in front of the large molars are very various in number, so that in different species, on the whole, $\frac{6-6}{6-6}$, $\frac{7-7}{7-7}$ or $\frac{7-7}{8-8}$ molars are present.

a) *With tail prehensile, naked in great part towards the end; with ears short, rounded.*

Sub-genus *Ceyonyx* TEMM., *Cuscus* LACÉP.

Sp. *Phalangista maculata* GEOFFR., DESMAR., BUFF. *Hist. nat.* XIII. Pl. 11 (*Phalanger mâle*), QUOY *et* GAIM. *Voy. de l'Uranie, Zool. Atlas*, Pl. 6,

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[1] GOLDFUSS proposed also the name *Morodactylus*; *Grundriss der Zoologie*, s. 629.

WATERHOUSE *Mammal.* I. p. 274; Moluccan Islands, New Guinea;—*Phalangista cavifrons* TEMM., *Didelphis orientalis* GM., *Phalangista rufa* GEOFFR., *Phalangista orientalis* WATERH., GUÉRIN *Icon., Mamm.* Pl. 21, fig. 1, CUV. *R. Ani., éd. ill., Mamm.* Pl. 51, fig. 1; Timor, Ceram, &c. These species have some analogy with Lemurids; they do not occur in New South Wales, nor in Van Diemen's Land; yet here probably ought to be placed a species from Cape York, the most northerly point of New Holland: *Phalangista nudicaudata* GOULD, *Proceed. Zool. Soc.* 1849, p. 110 (according to GOULD, a species of *Pseudochirus*, see below).

b) *With tail prehensile, hairy, having a naked streak below at the extremity; with ears elongate and triangular.*

Sub-genus *Trichurus* (*Trichosurus* LESSON[1]), *Phalangista* (in stricter sense).

Sp. *Phalangista vulpina* DESMAR., *Didelphis vulpina* and *lemurina* SHAW, *Phalangista Cookii* F. CUV., WATERHOUSE *Mamm.* I. Pl. 9, fig. 1; ruddy grey, end of the tail black, New Holland;—*Phalangista felina* WAGN., *Phalangista fuliginosa* OGILBY, GOULD *Mamm. of Austr.* II. Pl. 10; larger than the preceding, usually brown with throat ruddy; the tail is black; Van Diemen's Land. Of this division no species from the Moluccan Islands are known.

Sub-gen. *Pseudochirus* OGILBY. (With ears somewhat short; with two inner toes of fore feet separate from the rest.)

Sp. *Phalangista Cookii* CUV. (not F. CUV.), DESMAR., WAGN., *Phalangista Banksii* GRAY, *Phal. viverrina* OGILBY, COOK'S *Voyages*, VII. Pl. 75**, LESSON *Ann. des Sc. nat.* XVI. pp. 282—285, Pl. 12, WAGN., SCHREB. *Säugeth. Suppl.* III. S. 78, Tab. 155 B; grey-brown, point of the tail white; New South Wales, Van Diemen's Land.

Sub-genus *Dromicia* GRAY. (With true molars $\frac{3-3}{3-3}$; tail, except the hirsute base, covered with very short, close hair, naked below at the point; ears moderate, almost naked.)

Sp. *Phalangista nana* GEOFFR., DESMAR., *Phalang. gliriformis* BELL, *Trans. of the Linn. Soc.* XVI. Pl. 13, GOULD *Mamm. of Austr.* I. Pl. 8, WATERHOUSE *Nat. Lib.* Pl. 26; 4″ long, exclusive of the tail, which is 3″ 10‴ long and thick at the base; Van Diemen's Land.

Petaurus SHAW, *Phalangista* ILLIG. Skin expanded at the sides of the body between the arms and thighs. Tail hairy, not prehensile, long, sometimes longer than body.

Sp. *Phalangista taguanoides, Petaurus taguanoides* DESM., WATERHOUSE *Natur. Library*, Pl. 27; brown, whitish grey below; ears entirely haired, moderate; the largest species, 3½′ long, of which the tail forms the largest half, New South Wales;—*Phalangista petaurus, Petaurus flaviventer*

[1] *Ann. des Sc. nat.* XVI. 1829. p. 285.

DESMAR., *Petaurus australis* SHAW, *Hepoona Roo* WHITE *New South Wales*, Pl. 61, p. 288, GOULD *Mamm. of Austr.* I. Pl. 3; smaller than the preceding, a dark streak along the back; the ears longer and naked, the under surface yellowish, &c.

In a very small species the tail is shorter than the body and furnished along the two sides with long transverse hairs. Sp. *Phalangista pygmæa*, *Petaurus pygmæus* DESMAR., *Didelphis pygmæa* SHAW, SCHREB. *Säugeth.* Tab. 144 A, GUÉRIN *Icon., Mamm.* Pl. 21, fig. 3; it keeps in hollow stems of trees. From this species the genus *Acrobata* DESM. (or *Acrobates*) is formed. With the exception of the parachute, it closely corresponds with *Phalangista nana* or *Dromicia*.

Family V. *Peramelina.* Incisors, canines and molars; upper middle incisors not larger than the rest. Snout porrect, acuminate. Hind feet with second and third toes conjoined as far as the claws, with first (or pollex) mostly imperfect or indistinct.

Tarsipes GERVAIS. Teeth very small, separate; incisors $\frac{6}{2}$, the lower larger, procumbent, canines $\frac{1-1}{1-1}$, molars inconstant, deciduous, mostly $\frac{3-3}{3-3}$, remote. Snout very long, attenuate. Ears rounded, moderate. Feet pentadactylous, posterior somewhat longer, with pollex apart, clawless; claws flat, except those of the second and third toes of the hind feet acute, suberect. Tail long, with short fur, prehensile.

Sp. *Tarsipes rostratus* GERVAIS in GUÉRIN *Magas. de Zool.* 1842, *Mamm.* Pl. 35—37, WATERH. *Mamm.* I. Tab. 11, fig. 1, Pl. 19, fig. 6 (cranium), GOULD *Mamm. of Austr.* I. Pl. 1; in Western Australia; a small insectivorous animal living in trees, agreeing in some respects with *Phascologale* and *Myrmecobius*, but having the posterior thumb of the *Phalangistæ*. The teeth are quite abnormal, as they are in the genus *Proteles* amongst the *carnivora;* a cœcum is absent.

Perameles GEOFFR., *Thylacis* ILLIG. Incisors $\frac{5-5}{3-3}$, the upper and outer on each side separate from the rest; canines $\frac{1-1}{1-1}$, molars $\frac{7-7}{7-7}$, spurious molars $\frac{3-3}{3-3}$, true $\frac{4-4}{4-4}$, with crown quadrate, tuberculate. Snout porrect, acuminate. Ears elongate. Fore feet pentadactylous, with outer toe apart, very short; hind feet elongate, with pollex very short, clawless, apart or none. Tail moderate or somewhat short.

Comp. GEOFFROY SAINT-HILAIRE, *Mémoire sur un nouveau genre de Mammif. à bourse, &c., Ann. du Mus.* IV. pp. 56—65, Pl. 44, 45.

Sp. *Perameles nasuta* GEOFFR. l. l. Pl. 45, GUÉR. *Icon., Mamm.* Pl. 20, fig. 3, WATERH. *Nat. Libr.* Pl. 13, the *bandicost;* New South Wales, &c. In a species, larger than the others and nearly of the size of a rabbit, the ears are particularly long and the tail, furnished with long hairs, is black and at the point white; the thumb on the hind feet is wholly wanting: sub-genus *Macrotis* REID, *Peragalea* GRAY, *Perameles lagotis* WATERH. *Natur. Libr.* Pl. 12, *Mamm.* I. Pl. 13, fig. 1, GOULD *Mamm. of Austr.* I. Pl. 12; this species lives in Western Australia. For other species compare WATERHOUSE l. l.

Chœropus OGILBY. (Teeth of the preceding genus.) Feet slender, anterior didactylous, posterior with pollex none, fourth toe alone insistent, the rest small, apart, all unguiculate. Tail short slender. Ears elongate.

Sp. *Chœropus castanotis* GRAY, GOULD *Mamm. of Austr.* I. Pl. 13, WATERH. *Mamm.* I. Pl. 13, fig. 2; Southern Australia; a small animal 9½ inches long exclusive of the tail, which is 4 inches long. It is the only species of marsupial of which the fore feet have fewer than 5 toes.

Family VI. *Dasyurina.* Incisors, canines, and molars in both jaws; incisors $\frac{8}{6}$, canines longer than incisors. Anterior feet pentadactylous; posterior in some pentadactylous, with pollex very short and clawless, in others tetradactylous; second toe separate from third. Tail not prehensile, hairy.

Phascologale TEMM. Spurious molars $\frac{3-3}{3-3}$, true $\frac{4-4}{4-4}$, crown with conical, acute tubercles, the last upper small, transverse. Tail with hair short or penicillate towards the point.

Small mammals of which some species have no pouch, the young being protected by the hair alone of the body. Sp. *Phascologale penicillata* TEMM., *Didelphis penicillata* SHAW, *Dasyurus penicillatus* GEOFFR., WHITE *New South Wales*, Pl. 58, p. 281, SCHREB. *Säugeth.* Tab. 152 B*b*, GOULD *Mamm. of Austr.* I. Pl. 6; the skull and teeth figured by TEMM. *Monogr.* I. Pl. VII. figs. 9—12; length about from 15″ to 17″, of which the tail makes 7″ or 8″; a tuft of hair at the end of the tail; this species is spread over a great part of Australia, with exception of the north, and lives in trees. The two middle upper incisors are longer than the rest. Such however is not the case in all the species, for example, not in *Phascologale minima* TEMM., *Dasyurus minimus* GEOFFR., SCHREB. *Säugeth.* Tab. 152 B*e*, from Van Diemen's Land, in *Phascologale minutissima* WAGN.

Antechinus minutissimus GOULD *Mamm. of Austr.* IV. Pl. 4, from the East of Australia ($4\frac{3}{4}$″ long, of which the tail makes one half; the smallest species of the order) &c. These species, with a tail covered sparingly by short hairs, form the genus *Antechinus* MAC. LEAY. In some the tail is very thick at the base, especially in the males; they form the genus *Podabrus* GOULD.

Dasyurus GEOFFR. (excl. of some species). Spurious molars $\frac{2-2}{2-2}$, true $\frac{4-4}{4-4}$, tuberculate, the last upper small, transverse. Posterior feet with clawless hallucar wart, or pollex none. Tail lax, villous throughout.

Compare GEOFFROY SAINT-HILAIRE *Ann. du Mus.* III. pp. 353—363, and TEMMINCK *Monogr. de Mammal.* I. pp. 51—72, *sur les Mammif. du genre Dasyure et sur deux genres voisins, les Thylacines et les Phascogales.*

Sp. *Dasyurus maculatus* GRAY, *Viverra maculata* SHAW, *Dasyurus macrurus* GEOFFR., PHILLIP *Botany Bay*, Pl. 46, p. 276, PÉRON *et* LESUEUR, *Voy. aux Terr. austr.* Pl. 33; in this species the hind feet have a rudiment of a thumb; the fur is brown with white spots, which occur also on the tail; from Van Diemen's Land. In other species the thumb of the hind feet is entirely absent, as in *Dasyurus viverrinus* (and *Das. Maugei* GEOFFR. and F. CUV. *Mamm.* Pl. 100), *Didelphis viverrina* SHAW, PHILLIP l. l. Pl. 15, p. 147, WHITE *New South Wal.* Pl. 59, p. 285, SCHREB. *Säugeth.* Tab. 162 Bc, GUÉR. *Icon., Mamm.* Pl. 20, fig. 2; New South Wales, Van Diemen's Land; smaller than the preceding, tail unspotted. A larger species with short, large head and short tail has given occasion for the sub-genus *Sarcophilus* F. CUV.; it is the *Dasyurus ursinus, Didelphis ursina* HARRIS, *Linn. Trans.* IX. Pl. 19, fig. 2, named by the English colonists *native Devil;* it is black with a white patch on the breast between the fore legs, and has a bunch of very long hairs behind the eyes and another above them.

Thylacinus TEMM., *Peracyon* GRAY. Incisors even, or the external slightly larger; molars compressed, tricuspidate, spurious $\frac{3-3}{3-3}$, true molars $\frac{4-4}{4-4}$, the upper with an accessory tubercle internal, anterior. Ears short, hairy. Hind feet tetradactylous, with pollex none. Tail moderate, short-furred, thick at the base, somewhat compressed at the point.

Sp. *Thylacinus Harrisii* TEMM., *Didelphis cynocephala* HARRIS *Transact. Linn. Soc.* IX. Pl. 19, LESSON *Centur. Zool.* Pl. 2, CUV. *R. Ani., éd. ill., Mamm.* Pl. 49, fig. 1; GOULD *Mamm. of Austr.* III. Pl. 1, 2, Van Diemen's Land; the *tiger* or *zebra-wolf* of the colonists, of the size and form of a wolf, but lower on the legs; black transverse stripes on the back behind.

According to the observation of OWEN the *ossa marsupialia* are wanting here, or rather they are represented by fibro-cartilages in the external oblique muscles of the abdomen.

Myrmecobius WATERH. Molar teeth $\frac{8-8}{8-8}$ or $\frac{9-9}{9-9}$, the three anterior spurious, compressed, tricuspid, the posterior with crown having many conical, acute tubercles. Head acuminate. Hind feet tetradactylous, pollex absent. Claws compressed, curved, acute. Tail somewhat long, villous with long hairs.

Sp *Myrmecobius fasciatus* WATERHOUSE *Trans. of the Zool. Soc.* II. 2, 1838, p. 149, Pl. 27, 28, *Mammal.* I. Pl. 14, fig. 1, GOULD *Mammal. of Austr.* I. Pl. 10; a little animal of the size of a squirrel, grey-brown, with almost red feet, on the back dark-brown with white transverse bands. It is found in Western Australia and is supposed to live on insects, especially on ants.

Family VII. *Pedimana* WAGN. Incisors, canines and molars in both jaws; incisors $\frac{10}{8}$. Feet pentadactylous, the posterior a hand, with pollex apart, opposable to the other fingers, clawless, broad.

Didelphis L. Canine teeth long, curved, acuminate. Molars $\frac{7-7}{7-7}$, true $\frac{4-4}{4-4}$, cuspidate. Head produced, with gape of mouth large, produced as far as under the outer angle of eye. Bristles few, very long at the nostrils and lips. Tail furred at the base, elsewhere somewhat naked, scaly.

The proper *pouch-animal, opossum, le sarigue.* This numerous genus is peculiar to America, and, indeed (with the exception of two or three species) to South America, and represents there the Coescoes of India and the Dasyures of New Holland. These animals eat all kinds of food, principally insects, small birds and their eggs, reptiles, &c. and also fruits. Animals of this genus lived in the tertiary period; a nearly perfect skeleton of an opossum has been found in the gypsum of Paris; see CUVIER *Ann. du Mus.* V. pp. 277—292, Pl. 19.

Didelphis (in stricter sense). All the toes free.

† *With mammæ situated between two cutaneous folds of the abdomen, in place of a pouch.*

a) *With tail short, ears short* (*Habitus* nearly of *Sorex*).

Sp. *Didelphis tristriata* KUHL, WATERHOUSE *Nat. Libr.* Pl. 3;—*Didelphis tricolor* GEOFFR. DESM., *Didelphis brachyura* PALLAS *Act. Petrop.* 1780, II. p. 235, Tab. 5, BUFF. *Hist. nat., Suppl.* VII. p. 252, Tab. 61; Guyana;

grey, mixed with black above, red-brown along the sides, yellowish-white on the belly; 9 inches long, of which the tail forms 3, &c.

b) *With tail long, equalling or slightly surpassing the body, with ears somewhat long.*

Sp. *Didelphis dorsigera* L., SCHREBER *Säugeth.* Tab. 150; Surinam;—*Didelphis murina* L. SCHREBER *Säugeth.* Tab. 149, *Dict. univ. d'Hist. nat., Mamm.* Pl. 17, fig. 2; Brasil, Peru, &c. These species carry their young on the back when they are sufficiently developed to leave the teat, to which at first they were attached, whilst these throw their tails like tendrils round the tail of the mother.

†† *With mammæ contained in a pouch.* (*Tail long, but in many shorter than body.*)

Sp. *Didelphis virginiana* SHAW, BUFF. *Suppl.* VI. Pl. 33, 34, pp. 240—243, *Sarigue et Sarigue à longs poils,* SCHREB. *Säugeth.* Tab. 145*, GEOFFR. *et* F. CUV. *Mamm.* Pl. 96—98;—*Didelphis cancrivora* GMEL., SCHREB. *Säugeth.* Tab. 145, GEOFFR. *et* F. CUV. *Mamm.* Pl 99, GUÉR. *Iconogr., Mamm.* Pl. 20, fig. 1 (the skeleton figured by TEMM. *Monogr.* I. Pl. 5); from South America, brown-grey, with black feet, &c. Perhaps in some species the pouch is only temporally developed. T. T. REINHARDT saw a *Didelphis albiventris* without pouch, notwithstanding this species is otherwise instructed with it. *Videnskabel. Meddelelfer fra den naturh. Forening i Kjöbenhavn* for 1854.

Chironectes ILLIG. Hind feet palmate. (Mammæ contained in a pouch; tail longer than body.)

Sp. *Didelphis palmata* GEOFFR., *Lutra minima* ZIMMERM., BODD., *Chironectes variegatus* ILLIG., BUFF. *Suppl.* III. Pl. 22, WATERH. *Nat. Libr.* Pl. 4, *Mamm.* I. Pl. 17, fig. 1; CUV. *R. Ani., éd. ill., Mamm.* Pl. 48, fig. 4; *Yapock,* a species occurring in and near the rivers of Guiana and Brasil; it is about 2 feet in length, of which the tail forms one half. (The teeth, which were described by OGILBY in a young specimen, do not differ in the adult from those of the other species of *Didelphis.*)

SECTION II. *Mammalia placentalia.*

A) *Posterior extremities none.*

ORDER III. *Cetacea.*

Anterior feet changed into fins, posterior none[1]. Tail horizontal, flat, continuous with trunk. External ears none.

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[1] LINNÆUS wrote "Caudæ loco pedes compedes in pinnam planam." *Syst. nat. ed.* XII. I. p. 25. This mistake of LINNÆUS that the posterior extremities coalesce to form the tail was not without its influence, even after the skeleton had become known, in respect of the *Cetacea herbivora* (*Sirenia* ILLIG.); see ILLIGER *Prodrom.* p. 140 and FISCHER *Synopsis,* p. 501, the last of whom copied the first-named.

Family VIII. *Cetacea* (in stricter sense) *s. Cetacea carnivora.* Spiracles (external apertures of nostrils) on the top of head. Mammæ inguinal. Teeth different in different genera, conical, never molars with flat crowns, in some the teeth in an embryonic state only. Body destitute of hair.

Compare LACÉPÈDE *Hist. nat. des Cétacés*, Paris, XII. (1804) avec fig. 4to.

J. HUNTER *Observations on the Structure and Œconomy of Whales, Philos. Transact.* Vol. 77, 1787 (also in the separate edit. *Animal Œconomy*, by R. OWEN, 1837, pp. 331—392).

P. CAMPER *Observations anatomiques sur la structure intérieure et le squelette de plusieurs espèces de Cétacés, publ. par* A. G. CAMPER *avec des notes de* G. CUVIER *et un Atlas de* 53 *pl.* Paris, 1820, 4to.

F. CUVIER *De l'Histoire naturelle des Cétacés.* Paris, 1836, 8vo.

W. RAPP *Die Cetaceen zoologisch-anatomisch dargestellt.* Mit Abbild. Stuttgardt und Tuebingen. 1837, 8vo.

D. F. ESCHRICHT *Zoologisch-anatomisch-physiologische Untersuchungen über die nordischen Wallthiere*, I. Bd. Leipzig, 1849, folio. Mit Tafeln u. Holzschnitten.

The true cetaceans live almost all in the sea exclusively. Amongst them the largest animal species are met with. A thick layer of fat under the cuticle protects these animals from the cold, and diminishes their specific gravity. This layer of fat passes without any definite distinction into a firmer and more fibrous layer beneath the cuticle, so that the blubber forms a whole with the corium. The skin is without hair; but in the fœtal state in *Dolphins*, and even also in the whales in the adult state, some bristles are set upon the upper and sometimes also upon the lower jaw[1]. That water can be ejected from the blow-holes like a fountain, experienced observers are disposed to doubt; the animals breathe (blow) through the apertures, and the vapour mingled with the air may be seen as a condensed column, especially in cold regions, since the animal heat of these creatures is greater than in most mammals[2].

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[1] Compare ESCHRICHT *Untersuch. über d. nord. Wallthiere*, s. 71—75.

[2] W. SCORESBY *Account of the Arctic Regions*, Edinburgh, 1820, 8vo, I. p. 456; compare V. BAER, OKEN'S *Isis*, 1826, s. 811, 1828, s. 927—932, KUESTER *ibid.* 1835, s. 85, HOLBOELL in ESCHRICHT'S *Untersuchungen*, 193, 194, &c.

† *With head enormous, equalling in magnitude the third or fourth part of the trunk.*

Balæna L. Transverse horny laminæ adhering to the upper jaw in place of teeth. Two spiracles distinct.

The *whales*. The head is very large, making in some one-third of the whole length. These animals may be named toothless cetaceans, although in the state of embryo (as GEOFFROY SAINT-HILAIRE observed in *Balæna Mysticetus* at the beginning of this century) teeth are present, which, from the early ossification and coalescence of the groove in which they lie, do not come to view, *Ann. du Mus.* x. pp. 364, 365. ESCHRICHT afterwards confirmed this observation in various species, so that it may be regarded as a generally prevalent embryonal state. *Untersuchungen*, s. 85—91.

Compare on this genus J. A. BENNETT *Natuurl. Historie en Natuurk. Beschrijving der Walvisschen* in the *Natuurk. Verhandelingen van de Maatschappij der Wetensch. te Haarlem*, 1809, v. 1, with Pl.

Sp. a) With back finless; *Balæna Mysticetus* L., SCHREBER *Säugeth.* Tab. 332, LACÉP. *Cétac.* Pl. 1. fig. 1, both from MARTEN'S *Spitzbergische oder Groenländische Reise-Beschreibung*, Hamburg, 1675, 4to, Taf. Q, fig. K, SCORESBY l. l. Pl. 12, fig. 1, copied in SCHREBER *Säugeth.* 366, and CUV. *R. Ani., éd. ill., Mammif.* Pl. 100, fig. 1; the *Greenland whale, common whale, la Baleine franche.* This species attains a length of 60', and has the longest baleen, on each side more than 300 pieces. Its food consists of medusæ, conchifers and molluscs, amongst which last especially of *Clio borealis* (see above, 1. p. 775) and *Spiratella arctica* (1. p. 774). The whale fishery attained the greatest extension since the beginning of the seventeenth century, after the discovery of the island Spitzbergen[1]. On this subject may be consulted ZORGDRAGER'S *bloeijende opkomst der Groenlandsche visscherij*, 2e druk. 's Gravenhage, 1727, 4to, SCORESBY *Account*, &c. 2nd Pt. and by the same *Journal of a Voyage to the Northern Whale-fishery*, Edinb. 1823, 8vo. Another species without dorsal fin occurs on the south coast of Africa and in the South Pacific and also at Japan, *Balæna australis* DESMOULINS, *Balæna capensis* CUV.; see *Rech. sur les ossem. foss.* v. 1, p. 374, Pl. 25, fig. 1, 2, 5, 6, (*cranium*), SCHLEGEL *Faun. Japon., Mamm.* Taf. 28, 29. (Probably here also belongs BLUMENB. *Abb. Naturh. Gegenst.* 8vo, 91, from HESSEL GERARD *Descriptio geograph. transitus supra terras Americanas in Chinam*), *Dict. class. d'Hist. nat.* Pl. 140, fig. 3 (comp. DESM. *ibid.* II. 1822, p. 161). This species has a head of relatively smaller size. On it affix themselves *Balani* (*Tubicinella balænarum*, see above 1. p. 637), *Coronula balænaris* and species of *Cyamus*, of which animals no one has ever been observed on the Greenland whale.

b) *Adipose fin on the back.* Sub-genus *Balænoptera* LAC. Belly marked by longitudinal grooves.

The *fin-fishes* (*rorquals*) are not on the whole objects of the regular

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[1] In the memorable voyage of JACOB HEEMSKERK in 1596, when a part of the company passed the winter in Nova Zembla.

fishery, since their baleen is worthless and they afford less blubber. Here belongs *Balæna Boops* L. (not FABR.), *Bal. Physalus* FABR., *Balænoptera arctica* SCHLEG., LACÉP. *Cétac.* Pl. IV. fig. 1, BLUMENB. *Abb. Naturh. Gegenst.* No. 74; ROSENTHAL *Einige naturhist. Bemerkungen über die Wolle*, H. SCHLEGEL *Nieuwe Verhandelingen van de Eerste Klasse van het Koninkl. Nederl. Instituut*, III. Pl. 1, 2, *Abhandlungen aus dem Gebiete der Zoologie*, Leiden, I. 1841, Tab. VI. II. 1843, Tab. IX. This species appears to be the largest of all; there are several examples of animals more than 80 feet long (some even of 100); from time to time these whales are stranded on the coasts of the North Sea; these have afforded to Dr SCHLEGEL opportunity for accurate descriptions and figures[1]. A small species from the North is *Balæna rostrata* FABR., *Pterobalæna minor* ESCHR. Distinguished by long pectoral fins is *Balæna longimana* RUD., *Balæna Boops* FABR. (see RUDOLPHI *Abhandl. der königl. Akad. der Wissensch. zu Berlin a. d. Jahre* 1829, *Physikal. Kl.* s. 133—144, mit Abb.), the *sharp-lipped Whale*, the *Keporkak* of the Greenlanders; the same species also occurs south of the line at the Cape of Good Hope and elsewhere.

Physeter L., *Catodon* LAC. (*Physalus* and *Physeter* ejusd.). Spiracle single towards the apex of the truncated head or superior extremity of the snout. Lower jaw narrow, furnished with a row of large conical teeth having an internal cavity, upper jaw edentulous, or with a few teeth concealed under the gums.

Sp. *Physeter macrocephalus* SHAW et auctor. not L., LAC. *Cétac.* Pl. 10, BLUMENB. *Abb.* No. 84; *blunt-headed cachalot, spermaceti whale;* attains nearly the size of the Greenland whale, and is met with in various seas. Formerly several species of this genus were adopted, but it is not sufficiently demonstrated that they really consist of more than one; in one the blow-hole would appear to be not at the fore part of the head, but further back; this is the *Physeter macrocephalus* L., from which LACÉPÈDE formed his genus *Physalus*. For the specimens that have a dorsal fin LACÉPÈDE reserved the name of *Physeter*. But in all well-preserved specimens the so-named blow-hole opens at the fore part of the head, and there is a tubercle or false fin on the hind part of the back.

In special cavities of the head at the upper part of the skull a fatty substance is contained which hardens and then forms the *spermaceti*. The oil also (spermaceti oil or sperm oil of the English) is collected. In the intestines is found the *grey amber* (*ambra grisea*), a substance resembling cholesterine, which is used as a perfume, since when burnt it emits an agreeable smell; this substance is sometimes found drifting on the sea in warm countries or thrown up on the coasts. Comp. BRANDT *u.* RATZEB. *Mediz. Zool.* I. s. 108—111. The Cachalots feed chiefly upon cephalopods, and live together in large troops, especially in the great ocean between the west coast of America and the Eastern hemisphere, in which seas many Englishmen and North Americans are engaged in their pursuit.

[1] For the viscera compare W. VROLIK *Ontleedkundige aanmerkingen over den Noordschen vinvisch. Tijdschr. voor nat. Gesch. en Physiol.* IV. bl. 1—24.

†† *With head congruous, not surpassing the seventh part of trunk. (Blow-hole single.)*

Monodon L., *Ceratodon* BRISS., ILLIG. Two horizontal canine teeth in the upper jaw, in females mostly latent, enclosed, in males that of the left side exsert, very long, straight, subulate, porrect, grooved spirally, that of the right side concealed, solid; two other small teeth (spurious molars?) contained in the gum of upper jaw. Lower jaw edentulous. Cutaneous fold scarcely distinct, in place of dorsal fin. Transverse caudal fin, bilobed.

*Sp. *Monodon Monoceros* L., LACEP. *Cétac.* Pl. 4, fig. 3, Pl. 5, fig. 2, BLUMENB. *Abb. naturh. Gegenst.* No. 44, SCORESBY *Account*, II. Pl. 15, figs. 1, 2, CAMPER *Cétac.* Pl. 29—31 (cranium); the *Narwhal;* this species lives in the icy sea and feeds principally on cephalopods or sepiæ. It attains a length of thirteen feet, besides the long tusk of the male, which may be from eight to ten feet long. The tooth of the right side, which lies concealed in the jaw, is externally smooth and not hollow within. Comp. HOME *Lect. on comp. Anat.* II. Pl. 42. The two small teeth noticed amongst the generic characters were discovered by Prof. CL. MULDER; compare his valuable paper in the *Tijdschr. voor nat. Geschied. en Physiol.* II. 1835, bl. 65—109, Pl. 2. In the females both teeth usually remain latent. Occasionally Narwhals have been met with having two projecting tusks, but all the instances are not examples of it which were cited as such by ALBERS on the occasion of his describing one from the cabinet of FRORIEP: *Icones ad ill. Anat. comp.* Lipsiæ, 1818, Tab. II. III; compare G. VROLIK in *Bijdragen tot de Dierkunde*, published by the Society of Amsterdam, 3e Aflev. 1851, bl. 21—28, with large figures.

Delphinus L. Teeth conical, vertical, mostly numerous in both jaws. Caudal fin emarginate.

Hyperoodon LAC., *Uranodon* ILLIG., *Chænodelphinus* ESCHR., WAGN. Head rounded, with forehead declivous, produced abruptly into a short snout. Gape of mouth small. Teeth covered by gum. Blow-hole transverse, lunate, concave anteriorly. Adipose fin remote, small; pectoral fins small.

Sp. *Delphinus edentulus* SCHREB., *Hyperodon butskopf* LACÉP. (and *Delphinus diodon* ejusd.), LAC. *Cétac.* Pl. 13, fig. 3, SCHREB. *Säugth.* Tab. 346, 347, 348, fig. 1, HUNTER *Philos. Transact. for* 1787, Pl. 19, (*great Bottle-nose Whale*), WESMAEL *Notice sur un Hyperoodon*, Pl. 1. *Mém. de l'Acad. royale de Bruxelles*, XIII., W. VROLIK *Natuur- en Ontleedkundige Beschouwing van den Hyperoodon*, Pl. 1. *Nat. Verhandel. v. d. Maatschappij der Wetensch. te Haarlem*, V. 1. 1848, &c. (Figures of the skull in CAMPER *Cétac.* Pl. 13—16, W. VROLIK l. l. Pl. V—VII.; of the brain by ESCHRICHT in his paper, cited at p. 597, n. 1, Pl. VIII.). The adult animal appears to attain a length of from twenty-two to twenty-eight feet. In the skull the two erect ridges are especially observable, which the upper jaws present near the forehead.

Mostly there are two teeth, but sometimes also (M. A. HENDRIKSZ and C. MULDER *Alg. Konst- en Letterbode voor* 1831, 1 Deel, bl. 305, 306, 338—341, W. THOMPSON *Ann. and Mag. of Nat. Hist.* XVII. 1846, p. 152) four teeth at the fore part of the lower jaw, concealed in the gum; besides these some smaller teeth in addition lie also concealed in both jaws (ESCHRICHT *Untersuch. üb. die Wallthiere*, s. 37). This cetacean has occasionally been cast ashore on the coasts of Great Britain and Holland, otherwise it resides in high Northern latitudes, and usually keeps far from the shore; it is captured at the Faroe Islands, where it is named *Dögling*. The food of *Hyperoodon* consists chiefly of Cephalopods (*Loligines*), of which the horny beaks heaped up by thousands or sometimes within each other were found by VROLIK in the specimen dissected by him.

As SCHLEGEL has remarked, to this sub-genus ought also to be referred *Delphinus micropterus* CUV. (F. CUV. *Cétac.* Pl. 8, fig. r, DUMORTIER, *Mém. de l'Acad. royale de Brux.* XII. 1839, avec 3 pl.), from which *Delphinus Sowerbyi* DESMAR., *Physeter bidens* SOWERBY does not seem to differ, in the opinion of ESCHRICHT also, according to whom this last species is the male of *Delph. micropterus*. DUVERNOY forms from these species, which he contends are distinct, his genus *Mesodiodon; see Ann. des Sc. nat.*, 3ième Série, Tome XV. 1851, *Zool.* pp. 5, 71; compare also GERVAIS, ibid. XIV. pp. 5—17. Here belong fossil species from the tertiary beds named *Crag*, which were united by CUVIER in one genus under the name of *Zuphius*.

Platanista F. CUV. Teeth conical, projecting from the gums, numerous in both jaws. Blow-hole a longitudinal fissure. Snout produced, compressed. Dorsal fin depressed, remote. Pectoral fins subtriangular, broad at the posterior margin.

Sp. *Delphinus gangeticus* LEBECK, *Der Gesellschaft naturforsch. Freunde zu Berlin neue Schriften*, III. 1801, s. 280—282, Taf. II., *Delphinus rostratus* SHAW, F. CUV. *Cétac.* pp. 251—257, Pl. 8, fig. 2 (Pl. 18, figure of the skull), ESCHRICHT *Om Gangesdelphinen*, in *Kongel. Danske Vidensk. Selsk. Skr.*, 5te *Raekke, Natur. og mathem. Afdeling*, II. Bd. 1851, pp. 347—387, with 3 pl. This dolphin, which lives in the mouths of the Ganges, becomes 7′ long, and is distinguished not only by its long sword-shaped snout compressed laterally, but also by its eyes being so small that, on a superficial view, it might be supposed to be entirely blind. The blow-hole has a form quite unusual amongst cetaceans. In the rising ridges of the superior maxillary bones the skull resembles in some degree that of *Hyperoodon*.

Delphinus auctor. Several conical teeth projecting from the gums in both jaws. Blow-hole transverse, lunate, concave forwards.

The *Dolphins*. Amongst these the smallest cetaceans are found, of which only a few species attain more than ten feet. It is the only division of this family that is numerous in species; some are found in all seas, a few also in rivers. They are very voracious, and swim with great velocity. In some species the head extends forwards into a narrow snout (sub-gen. *Delphinus* CUV., *Rhinodelphis* WAGN.). Here belongs *Delphinus Delphis* L., LACÉP. *Cétac.* Pl. 13, fig. 1, BLUMENB. *Abb. naturhist. Gegenst.* No. 95,

GUÉR., *Iconogr., Mammif.* Pl. 47, fig. 1; the *common dolphin*, dorsal fin behind the middle of back; from forty to forty-five teeth on each side in both jaws. This species becomes 8′ long, and occurs in the North Sea and the Mediterranean Sea. It is the *Delphinus* of the ancients, of which they have given many wonderful accounts, amongst which the myth of ARION claims a distinguished place, HEROD. I. 241.—*Delphinus Tursio* FABR., CUV., HUNTER *Phil. Trans.* (1787), Vol. 77, Pl. 18, SCHLEGEL *Abhandl. aus dem Gebiete der Zool.* I. Pl. 5, figs. 1, 2, the *bottle-nosed dolphin*, about twenty-four teeth on each side above and below; the dorsal fin almost in the middle of the back; this species is usually from eight to eleven feet long, sometimes more.

In other species the head is not prolonged into a snout, but is blunt (sub-genus *Phocœna* CUV.). Here belongs *Delphinus Phocœna* L., SCHREBER *Säugth.* Tab. 342, CUVIER *Ménag. du Mus. national d'Hist. nat.* Livraison 7, with a figure of MARÉCHAL, CUV. *R. Ani., éd. ill., Mammif.* Pl. 97, fig. 3, GUÉR. *Iconogr., Mammif.* Pl. 47, fig. 2; the *common porpesse, le marsouin;* this species is rarely more than 4′ long, and is the smallest and most common of this family. It frequents the North Sea and also occurs in the Zuider-Zee; usually it keeps near the shore, and swims in company in large or small packs. There are from twenty to twenty-four small teeth on each side in both jaws; the dorsal fin stands on almost the middle of the back, nearer however to the tail than to the head. Compare on the anatomy of this species PAULSON *Skrivter of naturh. Selskabet*, II. 2, 1793, pp. 111—121, ALBERS *Icones ad ill. Anat. comp.* fasc. II. Tab. V—VII., V. BAER in OKEN'S *Isis* 1826, s. 807 u. ff., STANNIUS in MUELLER'S *Archiv*, 1849, s. 1—41 (description of the muscles), &c.—*Delphinus globiceps* CUV. *Ann. du Mus.* Tome 19, Pl. I. figs. 2, 3; this species with a blunt head belongs to those to which the name of *Butzkopf* has been assigned; it is called by English writers the *round-headed grampus;* it has a fin standing on the anterior part of the back, and only few teeth (nine or ten on each side of both jaws). This dolphin may attain a considerable length, more than 20′. In some species there is no dorsal fin. Of such LACÉPÈDE forms the unnecessary sub-genus *Delphinapterus.*—Sp. *Delphinus leucas* PALLAS *Zoogr. Rosso-Asiat.* Tab. I. SCHREB. *Säugth.* 349, SCORESBY *Arctic Reg.* II. Pl. 4; the *Beluga;* a large species from the high North; a very rare visitant of the British seas, JENYNS *Brit. Vert. Ani.* p. 43.

Family IX. *Sirenia* ILLIG. s. *Cetacea herbivora.* Nostrils opening in the upper lip at the anterior part of head. Molar teeth with flat crowns, or a horny lamina in place of teeth in both jaws. Two pectoral mammæ. Setæ in the lips; body furnished with scattered hairs, especially in younger individuals.

The *herbivorous cetaceans* were formerly placed in the neighbourhood of the seals; the lamantin was united with the walrus in the same genus (*Trichechus*). They are distinguished, however, like the true cetaceans, by the absence of hind limbs. CAMPER had shewn the resemblance of these animals to the whales (*Œuvres*, II. pp.

477—491, *du Dugon de* BUFFON; see also OZERETZKOVSKY in *Nov. Act. Acad. Scient. Petropol. ad annos* 1795, 1796, Tom. XIII.), and the great CUVIER also improved the systematic arrangement as regards these animals, inasmuch as the resemblance which this family bears to the walrus is merely superficial and external. On the other hand, it cannot be overlooked that there are many important peculiarities in the whole organisation which distinguish the herbivorous from the true cetaceans, and that therefore the union of these two families in one order is exposed to objections[1]. There are however difficulties of no less weight which oppose the union of the lamantins with the pachyderms.

The intestinal canal is long in these animals, and surpasses the length of the body eleven, fourteen, in the animal of STELLER twenty times. The stomach has two blind appendages at the pyloric portion, at least in the lamantin and the dugong; the pyloric portion is separated from the cardiac by a constriction; the cardiac portion is a blind appendage beset with many follicles. The heart is divided at the apex by a deep fissure (see various figs. in HOME *Lectures*, Vol. IV.). The ribs are numerous (15—19 pairs); in all, the *Manatus* included, there are traces of bones of the pelvis. These animals feed on marine plants (*Fuci*), and keep near the shores of the sea and the mouths of rivers.

Rhytina ILLIG., *Stellera* CUV.[2] Teeth none; a lamella with undulating surface, scarcely containing any calcareous matter, composed of horny tubules, covering both jaws internally. Head small. Body covered with thick, fibrous, fissured epidermis. Caudal fin lunate.

Sp. *Rhytina Stelleri* DESM., WAGN., *Trichechus Manatus borealis* GM., PALLAS *Zoogr. Rosso-Asiat.* I. p. 272, *Icon.* Fas. 2. This animal, which attains a length of twenty-four feet, formerly lived in the neighbourhood of the coast of Kamschatka at Behring's Island, and was discovered and described by STELLER in BEHRING'S second voyage; see *Nov. Comm. Acad. Sc. Petrop.* Tom. II. *ad annum* 1749, pp. 294—330 (and in a separate publication in German, *Ausführliche Beschreibung von sonderbaren Meerthieren*, Halle, 1753, 8vo). Since 1768 this animal has not been seen; on the discovery of BEHRING'S Island, which was uninhabited, its distribution had already become exceedingly limited. See VON BAER'S masterly *Untersuchungen über die ehemalige Verbreitung u. die gänzliche Vertilgung der von* STELLER *beobachteten Nordischen Seekuh*, St. Petersburg, 1838, 4to (*Mém. de l'Acad. imp. des Sc. de St Pétersb.* VI. Série, Tome V.). Of the dental laminæ BRANDT has given extensive details with figures, *Mém. de l'Acad. imp. des*

[1] Compare OWEN, *Proceedings of the Zool. Soc.* 1838, pp. 28—45.

[2] Or *Stellerus?* DESMAR. *Encycl. méthod.*

Sc. de St. Pétersb. VI. Série, Tome II. 1833, s. 103—118, Tab. 1. *et Symbolæ sirenologicæ*, ib. Tome V. 1846, pp. 1—160, Tab. I—V. A remarkable anomaly, but upon which no light can now be thrown, is the absence noticed by STELLER of fingers in the pectoral fins.

Halicore ILLIG. Two large upper incisors in adults, lower none; canine teeth none, molars $\frac{5-5}{5-5}$ or fewer, with flat crown. Pectoral fins destitute of claws. Caudal fin lunate.

Sp. *Halicore cetacea* ILLIG.; WAGN., *Halicore indica* DESMAR., *Halicore Dugong* QUOY *et* GAIM., HOME *Lect. on comp. Anat.* IV. Pl. 52, F. CUV. *Cétac.* Pl. 4, SCHREB. *Säugth.* Tab. 382, GUÉR. *Iconogr., Mammif.*, Pl. 46, fig. 2. This animal, named *Dugong* or *Dujong* by the Malays, occurs in the Indian Ocean and also in the Red Sea, from whence RUEPPELL has given a careful description of it, *Mus. Senckenb.* I. 1834, pp. 95—114, Tab. VI. This species becomes from 8′ to 10′ long (it has been stated at even 20′). The long upper incisors are for the most part (in the female entirely) concealed in the jaw. From these teeth the intermaxillary bones are uncommonly large, and the head has the appearance of being swollen forwards. Other smaller incisors in both upper and lower jaws may be observed in young individuals, but afterwards disappear. The surface of the mouth is covered in front with a hard integument, which corresponds to the horny plates of *Rhytina*. Compare on this animal and its anatomy, besides the memoir of RUEPPELL, BUFF. *Hist. natur.* XIII. Pl. 56 (skull), P. CAMPER *Œuvres*, II. pp. 477—491, Pl. VII. figs. 2, 3, QUOY *et* GAIMARD *Voy. de l'Astrolabe, Zool.* pp. 143—148, Pl. 27, OWEN *Proceed. of the Zool. Soc.* 1838, pp. 28—45, BISCHOFF in MUELLER'S *Archiv*, 1847, s. 1—6, Tab. I. (tongue-bone and larynx).

Manatus CUV. (*Manati* BODD.). Two small upper incisors, acute, in young age, in adults none; canines none; molars $\frac{8-8}{8-8}$; with crown square, divided by a transverse groove. Pectoral fins furnished sometimes with flat, marginal nails, with thumb always unarmed. Caudal fin oblong and rounded.

The *lamantin* or *sea-cow*. The intermaxillary bones, with their much smaller incisors, which disappear in old individuals, are less developed than in the preceding genus. In the under jaw also of young individuals traces of small incisors are seen, of which however the number is not fixed. Here also the anterior part of the cavity of the mouth is covered in both jaws with a hard and grooved integument.

It is now generally supposed that three species of this genus may be adopted, of which two are from the coasts of America, *Manatus australis* WIEGM. from Brasil, and *Manatus latirostris* HARLAN, from the coast of Florida, the West Indies and Surinam. LINNÆUS comprised both these species under the name of *Trichechus Manatus*. To *Manatus latirostris* belongs the figure of HOME *Phil. Trans.* 1822, Tab. 26, 27, *Lectures*, IV. Pl. 52, and the interesting anatomical description of W. VROLIK *Bijdragen tot de Dierkunde*, published by the *genootschap te Amsterdam*, 4de

Aflev. 1852. (Besides other characters this species is distinguished by 17 ribs, whilst the Brasilian has only 15 or 16.) *Manatus australis* is figured by HUMBOLDT, WIEGMANN'S *Archiv f. Naturgesch.* 1838, Taf. I. 11; to this also belong STANNIUS *Beiträge zur Kenntniss des Amerikanischen Manati.* Mit 2 lith. Taf. Rostock, 1845, 4to.

The third species *Manatus senegalensis* DESMAR., occurs on the west coast of Africa under the tropics; see ADANSON *Hist. nat. du Senegal*, p. 143; the skull is figured by CUVIER *Rech. sur les Oss. foss.* v. 1, Pl. 19, figs. 4, 5.

These animals attain a length of from 12′ to 15′ or more; their flesh, like that of the dugong, is eatable, and is famed as being palatable.

B) *Four distinct extremities.*

ORDER IV. *Pachydermata.*

Feet ungulate or furnished with nails which are flat and ungular, monodactylous, tridactylous, tetradactylous or pentadactylous. Molar teeth in both jaws, tuberculate, complex or lamellose, with crown broad, suitable for triturating; incisors and canines sometimes none. Stomach simple. (Ungulate animals, not ruminating vegetable food; with skin mostly thick, often thinly haired.)

The *Pachyderms.* Although a fossil genus (*Anoplotherium*) is furnished with two hoofs only, and in the hog not more than two hoofs rest on the ground; whilst two others, smaller and accessory, are raised above the ground (*ungulæ succenturiatæ* s. *accessoriæ*), as in many ruminant animals, yet these last, the ruminants, are not to be confounded with the former order. Of these the carpal and tarsal bones correspond in number to the number of the fingers, and do not coalesce to form a single bone. They have not a compound stomach, and never ruminate. All these animals are exclusively or principally herbivorous. We admit, however, that this order scarcely deserves the name of a natural division; and there is, for example, between *Hyrax* and *Elephas* in all the characters a difference almost as great as that between the bodily sizes of the two.

The ungulates are distinguished by the odd or even number of their toes; an arrangement first proposed by CUVIER *Rech. s. l. Ossem. foss.* sec. éd. 4to, III. p. 72, but afterwards abandoned. It was again advanced and strongly defended by OWEN in works cited below (p. 634). The elephants, from their peculiarities of structure, form an aberrant group. The remaining ungulates (with the exception of the ruminants which we regard as a distinct order) are grouped according to the odd or even number of their toes.

Phalanx I. *Proboscidea.*

Family X. *Elephantina.* Incisor teeth in upper jaw two, exsert, large; canine teeth none; molars large, with crown elongate. Feet pentadactylous. Nose elongated into a long, prehensile proboscis. Two pectoral mammæ.

To this division belongs only a single genus now living, that of the elephants, of which also there are fossil remains from the diluvial period. To it belongs in addition the extinct genus *Mastodon* Cuv., in which the crowns of the molars have nipple-shaped tubercles placed in pairs, and of which the species lived in the tertiary and diluvial periods.

Mastodon giganteus Cuv., Pander u. D'Alton *Die Skelete der Pachydermata,* Tab. III. The fossil remains of this animal are found in North America. (The name of *Mammoth* has been given incorrectly to this animal; it belongs to *Elephas primigenius.*) A skeleton of this species is known that weighs 1000 pounds; it was of the height of the elephant but longer. In younger individuals two incisor teeth occur in the under jaw also; they are short and lie horizontally; these have introduced the genus *Tetracaulodon;* Godman *Transact. of the American Phil. Soc.,* new Series, Vol. III. P. 2, Philadelphia, 1830, pp. 478—485 (transferred to the *Ann. des Sc. nat.* XX. 1830, pp. 292—301). Sometimes one or two incisors are persistent on the right side, in the male according to the surmise of Owen, which would seem to be analogous to the tusk of the male Narwhal (*Annals and Magaz. of nat. Hist.* XI. 1843, pp. 147—151; see also Owen, *History of British fossil Mammals and Birds,* London, 1846, pp. 292, 293, and Laurillard in the fourth edition of Cuvier *Rech. sur les Oss. foss.* 1834, II. pp. 372, 373. Remains of *Mastodon* are found in various countries of Europe which belong to another species (*Mastodon angustidens* Cuv.); see Cuvier *Rech. sur les Oss. foss.* I. 3ième éd. p. 250 et suiv. But the distinction between *Mastodon* and the elephants is not so sharply defined, or else there exist transitions in some molars which have been dug up. Owen *Hist. of Brit. foss. Mamm.* p. 273, *Odontography,* p. 614.

Elephas L. Molar teeth mostly $\frac{2-2}{2-2}$, lamellose.

The large tusks, which supply the *ivory,* are the incisors of the upper jaw. The molars, consisting of several plates united together by cement (see p. 575), succeed each other from behind forward, by slow advancement. Commonly two such are visible, sometimes three or even one only. Although there are five fingers, yet these are not distinguishable on the heavy feet, which appear as though truncated, except by the nails or hoofs, which on the fore feet are five or four in number, on the hind feet four or three. The most remarkable part of the elephant is its proboscis or trunk, of which we have already spoken above. The elephants live in forests in the tropical regions of the old world, mostly in troops. The size of these animals is

generally exaggerated; only very rarely have any been seen which exceeded 10 feet in height. They live to a great age (100 years and more); gestation lasts 20 or 21 months; the young one sucks with the mouth, not with the trunk. It is generally known that elephants are very docile; the ancients appear to have advanced much further in the education and instruction of these animals than people of the present day; see PLINIUS *Hist. nat.* Lib. VIII. cap. 3, ÆLIANUS *de Natura animal.* Lib. II. cap. 11.

Compare on the elephant amongst others P. CAMPER *Description anatomique d'un éléphant mâle, publiée par* A. G. CAMPER, *Œuvres de* P. CAMPER, II. pp. 1—282; CORSE *Observations on the manners, habits and nat. Hist. of the Elephant, Phil. Trans. for* 1799, p. 31 sqq.; CUVIER *l'Éléphant des Indes, Ménag. du Mus.* 2e et 8e Livraisons (éd. 12mo, I. pp. 83—125, II. pp. 45—65); MAYER *Beiträge zur Anat. des Elephanten und der übrigen Pachydermen. Nov. Act. nat. curios.* Tom. XXII. 1847.

LINNÆUS adopted only one species of elephants, under the name of *Elephas maximus.*—BLUMENBACH, who was indebted for the observation to CAMPER (*Œuvres de* P. CAMPER, II. p. 69), was the first who distinguished two species by their molar teeth.

Elephas africanus BLUMENBACH, CUV., GEOFFR. ST.-HILAIRE and F. CUV. *Mamm.* Livr. 51 (copied in SCHREBER *Säugth.* Tab. 317 D), CUV. *R. Ani., éd. ill., Mamm.* Pl. 76, fig. 1.; (a molar figured in BLUMENB. *Abb. naturhist. Gegenst.* No. 19 C); the molars present rhomboidal bands of enamel on the crown, so that the plates of which they consist are thicker in the middle than on the in- and outside; the forehead is convex; the ears are uncommonly large, semicircular flaps. This species occurs in tropical and South Africa.

Elephas asiaticus BLUMENB., *Elephas indicus* CUV. *Ménag. du Mus.* II., GEOFFR. ST.-HILAIRE *et* F. CUV. l. l., SCHREB. *Säugth.* Tab. 317 C, GUÉR. *Iconogr., Mamm.* Pl. 37, fig. 1, *Dict. univ. d'Hist. nat., Mamm.* Pl. 9 B; a molar figured by BLUMENB. l. l. fig. B; the bands of enamel on the worn crowns of the molars are narrow, parallel and sinuous; the ears are smaller and narrower; the head longer; the forehead is somewhat concave. (Both species are figured in the *Dict. des Sc. natur., Mammif.* Pl. 82, *cahier* 43, and their skulls in GOETHE *und* D'ALTON *Zur vergleichenden Osteologie, Nov. Act. Acad. Leop. Carol. Nat. Cur.* XII. 1, 1824, Tab. 33—35.) This Asiatic elephant occurs on the continent of India and in Ceylon; at Java no elephants are found. At Sumatra, on the contrary, a species of elephant is indigenous, which, according to the remark of TEMMINCK, forms a third species, *Elephas sumatranus* TEMM., of which the dental laminæ are thicker and less numerous than in the common Indian species; it has 20 pairs of ribs, whilst the Indian species has only 19. *Coup d'œil général sur les Possessions Neerl. dans l'Inde,* II. 1847, pp. 91, 92. (Since the elephant, as some testify, occurs also in certain parts of Borneo, it may be surmised that it is probably this *Sumatran* species.)

There are also remains of elephants belonging to a former animal world (from the diluvial period), amongst which the *Elephas primigenius* BLUMENB., the *Mammoth*[1], is best known. In Holland, too, bones and molars

[1] Properly *Mammont;* see *Bulletin de la Soc. imp. de Moscou,* I. 1829, pp. 267—271.

of it are found from time to time. (See M. VAN MARUM *Natuurk. Verhandel. van de Mdtsch. der Wetensch. te Haarlem*, XIII. 1824, bl. 213—304 with figure.) Throughout Asiatic Russia, especially in the most northern parts of Siberia, such remains are so abundant that the number of elephants now living has been estimated, not without apparent probability, as less than that of those whose remains are dispersed throughout the regions mentioned. Near the mouth of the Lena the frozen body of an elephant was found in 1805, covered with hairy skin, whose two tusks weighed together 300 pounds. (A more recent example of an entire skeleton with the soft parts preserved in part, found in Siberia, even permitted a microscopic examination of the tissues; see GLEBOFF *Bullet. de la Soc. imp. de Moscou*, XIX. 2, 1846, pp. 108—134.)

Compare on this subject especially CUVIER *Mém. sur les Éléphants vivans et fossiles, Ann. du Mus.* VIII. pp. 1—58, pp. 93—155, pp. 149—269, and *Rech. sur les Ossem. fossil.* I. 3ième édit. pp. 1—204; and, for many species more recently discovered in the sub-Himalayan hills, CAUTLEY and FALCONER *Fauna antiqua Sivalensis*, with fig.

Phalanx II. *Perissodactyla* OWEN. Ungulates with odd number of toes on the hind feet at least.

In this group the dorso-lumbar vertebræ are never fewer than twenty-two. The femur has a third trochanter. The fore part of the astragalus is divided into two very unequal façettes. The middle toe is large and symmetrical. If the species be horned, the horn (one or two) is placed in the mid line of the head. The crown of from one to three of the hinder premolars is generally as complex as those of the molars. The stomach is simple, the cœcum large and sacculated. See OWEN *On the Hippopotamus, with an attempt to develope* CUVIER'S *idea of the Classification of Pachyderms by the number of the toes, Journal of the Geol. Soc. of London*, IV. 1848, pp. 103—294, and the same *On the characters, principles of division, and primary groups of the class Mammalia* in *Proceed. of Linn. Soc.* Vol. II. No. 5, 1857, pp. 27, 28.

Family XI. *Nasicornia* ILLIG., *Pachydermata* BLAINV. Incisors persistent in both jaws in some, in some disappearing from age; canines none; molars tuberculate, the crown marked by exsert eminences, mostly $\frac{7-7}{7-7}$. Feet tridactylous, with all the toes insistent, ungulate. Single horn or two horns placed one behind the other in the midle of muzzle and of forehead. Skin thick, thinly haired, marked by deep folds.

Rhinoceros L. (Characters of the family those also of the single genus. Crown of the upper molars subquadrate, with two

transverse eminences, joined by a crest to the outer margin; crown of the lower elongate, narrower, with two lunate lines convex outwards. Horn or horns without any bone, composed of longitudinal fibres closely compacted, as of concrete hairs.) Two mammæ inguinal.

The *rhinoceroses* are heavy animals with a long head and a short tail; they live, like the elephants, in the warmest countries of the old world. At the feet is a gland, which appears to have been first discovered by OWEN; it opens on the posterior surface, just as a similar gland opens on the anterior surface in sheep (see below). The villi of the small intestine are very large. The intestinal canal is eight times as long as the body. The large intestine is very wide and forms several saccules at its commencement. See OWEN *On the Anatomy of the Indian Rhinoceros, Transactions of the Zoolog. Soc.* IV. pp. 31—58, Pl. 9—22.

The names of *Rhinoceros unicornis* and *bicornis* (LINN. *Syst. nat.* ed. X. et XII.) can be no longer retained, since more than one species is known both of those with one and of those with two horns.

a) *With incisor teeth in both jaws.*

Sp. *Rhinoceros indicus* CUV., *Rhinoceros unicornis* L., *Ménag. du Mus.* éd. 12mo, II. pp. 111—145, BUFF. *Hist. nat.* XI. Pl. 7, GUÉRIN *Iconogr., Mamm.* Pl. 37, fig. 3. The skeleton in CUVIER *Ann. du Mus.* III. pp. 32—52 with figures, PANDER u. D'ALTON *die Skelete der Pachyderm.*, Tab. VIII.—*Rhinoceros sondaicus* HORSFIELD, DESMAR., *Rhinoceros javanus* CUV. (*R. Ani. sec. éd.*), WAGN., HORSFIELD *Zool. Researches in Java*, No. VI. (with fig., copied in SCHREB. *Säugth.* Tab. 317 E), SAL. MUELLER *Natuurk. Verh. over de Overzeesche Bezittingen, Mamm.* Pl. 33; at Java, perhaps also at Borneo.—These two species have only one horn. Two-horned is *Rhinoceros sumatrensis* CUV., *Rhinoceros sumatranus* RAFFL., WAGN., W. BELL *Phil. Trans. for the year* 1793 (with figures of the animal and of the skull), GEOFFR. ST.-HIL. *et* F. CUVIER *Mammif.* Livr. 47 (copied in SCHREBER'S *Säugthiere*, Tab. 317 G), SAL. MUELLER l. l. Pl. 34; the smallest of the known species. In all these species there are four incisors in both jaws, at least when young, of which in older individuals usually two alone persist, especially in the upper jaw. The two small incisors are placed in the upper jaw on the outside, in the lower on the inside of the large ones. The small teeth, as it seems, are permanently concealed in the gum.

b) *With incisor teeth in lower jaw latent, small, in upper jaw none or disappearing early. (Head obtuse, with molar teeth advancing nearly to the extremity of both jaws. Two horns.)*

Sp. *Rhinoceros africanus* CAMPER, CUV., *Rhinoceros bicornis* L., P. CAMPER *De cranio Rhinocerotis africani, cornu gemino, Act. Acad. Petropol.* 1777, P. 2, pp. 193—210, *Natuurk. Verhandelingen over den Orang outang, over den Rhinoceros met dubbelen horen en over het rendier.* Amsterdam, 1782, 4to; *Œuvres*, I. pp. 197—290 (with figures of the head and skull; see also

a figure of the skull after CAMPER in BLUMENB. *Abb. naturhist. Gegenst.* No. 7 A), BUFF. *Hist. nat., Supplém.* VI. Pl. 6 (with description by ALLAMAND). This species is very dangerous by night for travellers, and has an acute sense of hearing and still more acute of smelling; LICHTENSTEIN'S *Reisen*, I. S. 583. Prof. G. VROLIK was the first who shewed that in this African species also there are four small incisors in the lower jaw, which however do not come into view from the gum, and in older individuals commonly fall away either wholly or in part. *Bijdragen tot de natuurk. Wetensch.* V. bl. 377—385, with a figure. In recent times other two-horned African rhinoceroses have been announced as distinct species. *Rhinoceros simus* BURCHELL, A. SMITH *Illustrations of the Zoology of South Africa*, London, 1849, 4to, Pl. XIX. &c.

There are various fossil species of *Rhinoceros*. To these belongs *Rhinoceros tichorhinus* CUV., *Rhinoceros Pallasii* DESM. from the diluvial period, of which remains are found here and there in Europe, but especially in Siberia, where in 1751 a nearly entire specimen of this species covered with its skin was dug out from the ice. See also BRANDT *De Rhinocerotis antiquitatis structura externa et osteologica, Mém. de l'Acad. imp. de St. Pétersb.* VIIème Série, *Sc. math. phys. et nat.* Tome VII. 1849, pp. 161—416, *c. 25 tab. lithogr.* This species had two horns and, like the African species, no persistent incisors. In the tertiary formations also, of various antiquity, remains of the rhinoceros have been found, ex. gr. *Rhinoceros incisivus* CUV. Compare CUVIER *Ann. du Mus.* VII. *Rech. sur les Ossem. fossiles*, II. pp. 1—93, DUVERNOY *Archives du Mus.* VII. 1853, pp. 1—144, Pl. I—VIII. &c.

It would seem that in the neighbourhood of *Rhinoceros* ought to be placed the fossil animal, to which FISCHER has given the name of *Elasmotherium*, and of which only a portion of the lower jaw is known.

Family XII. *Lamnungia* ILLIG. Incisor teeth $\frac{2}{4}$, canines none, molars $\frac{7-7}{7-7}$ or $\frac{6-6}{6-6}$. Fore feet tetradactylous, hind feet tridactylous. Hoofs small, flat, with the exception of the claw, which adheres to the inner toe of the hind feet, and is curved, oblique.

Hyrax HERMANN, ILLIG., CUV., *Cavia* L., species of *Cavia* PALLAS. Characters of the family those also of the single genus. Body hairy. Bristles on the face around the nostrils and above the orbits. Some long setæ, scattered amongst the shorter hair of the body. Tubercle in place of tail. A single small false molar on each side (or canine) deciduous. Crown of upper molars with two eminences joined by a crest to the outer margin; crown of lower molars with two lunate lines, convex outwards.

Sp. *Hyrax capensis* SCHREB., *Säugth.* Tab. 240, *Cavia capensis* PALL. *Misc. Zool.* pp. 30—47, Tab. 3, 4, *Spicil. Zool.* Fasc. II. pp. 16—32; VOSMAER

Beschr. van eene soort van Afrikaansch Basterd-mormeldier; Amsterd. 1761, with col. fig., SCHINZ *Monographien der Säugth. 6tes Heft*, 1845, Tab. 1, upper fig.; the *daman, Klipdachs;* a little animal of the size of a rabbit, eatable, according to KOLBE very tasty. It lives in mountainous districts in the neighbourhood of the Cape of Good Hope (as on Table-mount) and also in Abyssinia, *Hyrax habessinicus* EHRENB. (See such a specimen figured in GEOFFR. ST.-HILAIRE *et* F. CUVIER *Mammif.* Livrais. 54.) In Syria also a species has been found on the mountains near the Red Sea, *Hyrax Syriacus* SCHREB. *Säugth.* Tab. 140 c. (and *Hyr. ruficeps* EHRENB. *Symb.*), perhaps the *Saphan* of the Old Testament. Another species from South Africa lives in woods, *Hyrax arboreus* SMITH, *Linn. Trans.* XV. 2, pp. 468—470; it has longer hair and a white spot on the back; PETERS found this in Mosambique also to the 15° S. L. A fourth species, which lives in hollow trees, and is said to climb to the tops of the trees to seek their fruits, is *Hyrax sylvestris* TEMM., from the coast of Guinea. It has only six molars on each side in both jaws. LINNÆUS (*Syst. nat.* éd. 12, Tom. III. Append. p. 223) named this genus *Cavia*, a name however which was afterwards given to American rodents. HERMANN distinguished this genus by the name of *Hyrax* (*Tab. Affinit. Animal.* Argentorati, 1783, 4to, p. 115), which is commonly adopted. These animals were placed at first amongst the rodents, with which they have undoubtedly some agreement. Afterwards WIEDEMANN (*Arch. f. Zool. u Zoot.* III. 1802, s. 42—51), and especially CUVIER, asserted, on good grounds, that this genus belongs to the Pachyderms; the molar teeth have entirely the same form as those of *Rhinoceros* (*Ann. du Mus.* III. pp. 171, 182). The malar bone forms behind the orbit a more perfect ring than in any other genus of this order; in the New Guinea species the ring is even perfectly closed by its joining the frontal bone. Compare on this genus also H. KAULLA *Monographia Hyracis*, Stuttgardiæ, 1830, 4to.

Family XIII. *Tapirina.* Incisors, canines, and molars in both jaws. Anterior feet tridactylous or tetradactylous, posterior tridactylous.

Tapirus BRISS., ILLIG., CUV. (*Tapir* GMEL. *Hydrochœrus* BODD.[1]) Incisors $\frac{6}{6}$, the two upper and outer conical, resembling canines; molar teeth $\frac{6-6}{6-6}$ or $\frac{7-7}{6-6}$, separate by a void interval from the canines, crown with two exsert, transverse lines. Anterior feet tetradactylous, posterior tridactylous. Nose produced into a

[1] BODDAERT *Elench. animal.* p. 161. In the twelfth edition of the *Syst. naturæ* the Tapir is not noticed; in the tenth LINNÆUS placed this animal under the name of *Hippopotamus terrestris.* ERXLEBEN had already named it (*Syst. regni anim.* 1777) before BODDAERT *Hydrochœrus*, but united with it under the same name the *Capibara*, a large rodent; see below.

small mobile proboscis. Tail very short. (Dental formula OWEN, i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{4-4}{3-3}$, m. $\frac{3-3}{3-3} = 42$.)

Sp. *Tapirus americanus* auctor., *Tapirus suillus* BLUMENBACH, WAGN., BUFF. *Suppl.* VI. Pl. I. SCHREB. *Säugth.* Tab. 319, CUV. *R. Ani., éd. ill., Mammif.* Pl. 82, fig. 3; the *tapir, Anta, Mborebi* (AZARA *Essais*, I. pp. 1—17); this animal lives in South America, principally in the neighbourhood of the east coast, in woods and moist places on the banks of rivers; it attains a length of from five to six feet. Another American species that lives on mountains was found some years ago by ROULIN, *Ann. des Sc. nat.* XVIII. 1829, pp. 26—56, Pl. I. 2, *Tapirus villosus* WAGL., SCHREB. *Säugth.* Tab. 319 B.—*Tapirus malayanus* HORSF., *Tapirus indicus* F. CUV., *Tapirus bicolor* WAGN., HORSFIELD *Zool. Res. in Java*, No. I. SCHREB. *Säugth.* Tab. 319 A, GUÉR. *Iconogr., Mammif.* Pl. 39, fig. 2; larger than the two preceding species, the back white backwards; at Sumatra and the peninsula Malacca.

Fossil species of *Tapir* occur in tertiary formations. *Tapirus giganteus* of CUVIER belongs to the genus *Dinotherium* KAUP, which with the molars of the tapir has also two very large tusks in the lower jaw directed downwards. It belongs to the tertiary period. By OWEN it is classed with the *Proboscidea.*

Note.—Palæotherium CUV. (A fossil genus of the tertiary strata, related to *tapir*, with all the feet tridactylous.)

Sp. *Palæotherium magnum, Pal. medium*, &c. Comp. CUV. *Ann. du Mus.* Tome III. IV. VI. IX. XII., *Rech. s. les Oss. foss.* III. 3ième édit. pp. 1—258.

On other fossil genera of this division omitted here consult PICTET.

Family XIV. *Solidungula.* Feet with a single perfect toe, covered by a broad hoof, without supplementary hoofs. Incisors in a continuous series in both jaws; molar teeth complex. Two inguinal mammæ.

Equus L. Incisors $\frac{6}{6}$, canines $\frac{1-1}{1-1}$ or none, molars in adults $\frac{6-6}{6-6}$, in younger individuals with a small anterior molar, deciduous[1]. Mane at the neck.

All the species of the genus *horse* belong to the old world, and are at home on the wide mountain-plains of Asia and Africa. They live together in troops, are very swift, and feed chiefly on species of grass. The intestinal canal is wide and long; they have a simple stomach, a large cœcum, and no gall-bladder.

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[1] In young horses there is in both jaws a small anterior molar (*wolf-tooth* of Dutch writers); see L. BOJANI *Adversaria ad dentitionem Equini generis et ovis domesticæ spectantia; Nov. Act. Acad. Cæs. Leop. Car.* XII. 1825, pp. 697 sqq.

Sp. a) *With tail hairy throughout, Equus Caballus* L.; the *horse;* this animal is no longer met with in its original wild state, but has returned to that state in the steppes of Asia and the extensive plains of South America. The wild horses differ from the tame by their larger head and smaller size; see SCHREBER *Säugth.* Tab. 309. There is no domestic animal more highly prized by man that the horse. The horse lives about thirty years; there are, however, examples of horses that have been forty or more years old. They go with young eleven months. In the fifth year all the milk teeth are replaced by permanent teeth. Of this animal the beautiful description of BUFFON, *Hist. nat.* IV. pp. 174—257, may be referred to as well as the finished memoir of J. A. WAGNER in SCHREBER'S *Säugthiere,* VI. s. 15—169. For the different races may be consulted D'ALTON *Naturgeschichte des Pferdes,* 1ter Thl. folio transv. Weimar, 1812 (2ter Theil, *Anatomie des Pferdes,* 1816), KUNZ *Abbildungen sämmtlicher Pferde-Racen, mit Bemerkungen von* D'ALTON, Karlsruhe, 1827, fol. On the true proportions of the exterior of the horse BOJANUS has treated in the *Isis* of OKEN, 1823, I. s. 106—112, Taf. 1. On the anatomy of the horse there are many works, as J. D. SAUNIER *Parfaite connaissance des Chevaux,* La Haye, 1734 fol., G. STUBBS *The Anatomy of the Horse,* BOURGELAT *Précis anat. du corps de Cheval,* &c. Also LEYH'S *Handbuch der Anatomie der Hausthiere* (Stuttgart, 1850, 8vo), as treating especially of the horse, and illustrated by many excellent wood-cuts, must not be forgotten by us.

b) *With tail hairy at the extremity,* Sp. *Equus Asinus* L., the *ass;* a black cross over the shoulders; long ears. The wild ass (*Equus onager,* the *Kulan* of the Kirgisses, see SCHREBER *Säugth.* 312 after PALLAS; compare EVERSMANN *Bulletin de la Soc. de Moscou,* 1840, pp. 56, 58), lives in large troops in Tartary, and moves in the winter to more southern regions[1]. The ass as a domestic animal is commonly as much neglected as the horse is cherished and cared for. The horse and the ass copulate together and produce a spurious breed of two sorts; the *mule, mulus, le mulet,* from an ass with a mare, and the *mule-ass, hinnus, le bardeau,* from a stallion with a she-ass. These spurious breeds are only rarely prolific[2].

Equus hemionus PALL., *Nov. Comm. Acad. Petrop.* Tom. XIX. Tab. 7; *Dziggetai* or *Dsikkelai* of the Mongols, light-brown or ruddy yellow, with a black stripe on the middle of the back; lives in the sandy plains of central Asia. Very similar seems the *Kiang* (*Proceed. Zool. Soc.* 1848, pp. 62, 63, 1849, pp. 29, 30), if this be really a peculiar species.

South Africa has three striped species of this division: *Equus zebra* L., *Equus montanus* BURCHELL, *het wilde paard,* BUFF. XII. Pl. 1, SCHREBER *Säugth.* Tab. 316, *Ménag. du Mus.* 6d. 8vo, II. pp. 194—206, with fig.; striped black and white, the legs ringed black and white;—*Equus quagga* GM., BUFF. *Suppl.* VI. Pl. 7, SCHREB. *Säugth.* Tab. 317, 317 A, *Ménag. du Mus.* I. pp. 311—318, with fig., GUÉR. *Iconogr., Mammif.* Pl. 41, fig. 1;

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[1] Here also belongs the *Hemionus* of ISID. GEOFFROY SAINT-HILAIRE, *Nouv. Ann. du Mus.* IV. 1835, p. 97, Pl. 8.

[2] The she-mule-ass, for example of ZOPYRUS, see HERODOTUS, III. 153, comp. 151.

brown with black stripes, belly and legs white; very shy, lives in troops of 80 to 100 together; the *Khoüa Khoua* of the Hottentots;—*Equus Burchellii* FISCH., *Equus zebra* BURCHELL, *Equus festivus* WAGN., *Equus montanus* F. CUV., GRIFFITH, GEOFFR. SAINT-HILAIRE *et* F. CUVIER *Mammif.* Livr. 55, 56, SCHREB. *Säugth.* Tab. 317 B, *Dict. univ. d'Hist. nat., Mammif.* Pl. 10, fig. 2; striped white and black like the zebra, but with white legs; BURCHELL has described this new species as the zebra, *Travels in the interior of Southern Africa*, London, 1822, I. p. 139. The prolific copulation of the zebra with the ass (*Ann. du Mus.* VII. p. 245, IX. p. 223) and with the horse (ibid. XI. pp. 237—240) has been observed. On fossil horses (*Equus fossilis* and *Equus primigenius*), compare MEYER, *Nov. Act. Acad. Cæs. Leop. Car.* XVI. p. 423 sqq.

Phalanx III. *Artiodactyla* OWEN. Ungulates with number of toes even.

In the even-toed ungulates the number of the dorso-lumbar vertebræ is constant (19) in all the species. The femur has not a third trochanter. The fore part of the astragalus is divided into two equal or subequal façettes. The digit answering to the third in the pentadactylous foot is not symmetrical, but forms with that answering to the fourth a symmetrical pair. When there are horns, they are never developed singly, but are placed on each side of the median line in one pair or two. The crowns of the premolars are smaller and less complex than those of the true molars. The stomach is complex, the cœcum small, the colon spirally folded. From OWEN *On the characters, &c., Proceed. of Linn. Soc.* II. No. 5. pp. 28, 29.

Anoplotherium CUV. Fossil genus. Incisors $\frac{6—6}{6—6}$, canines $\frac{1—1}{1—1}$ included, not longer than incisors, molars $\frac{7—7}{7—7}$, all contiguous.

All the species are found in the older tertiary strata. The *Anoplotherina* were divided by CUVIER into three genera, viz. *Dichobune*, *Xiphodon* and *Anoplotherium* in stricter sense. Comp. *Ann. du Mus.* III. *et* IX., *Rech. s. les Ossem. foss.* III. Through the labours of later observers allied genera have been added to these, on which consult PICTET.

Family XV. *Suina.*

Sus L. Incisors various in number, in the lower jaw mostly six, the upper sometimes none, in a few the lower deciduous also; canines in both jaws distinct, large; molars $\frac{3-3}{3-3}\frac{7-7}{7-7}$. Feet with hoofs insistent, tetradactylous, posterior sometimes tridactylous. Nose with snout truncate, mobile, prominent. Tail short or a tubercle in place of tail.

Dicotyles Cuv. Hind feet tridactylous, the outer accessory hoof being deficient. Tubercle in the place of tail. Incisors $\frac{4}{6}$, canines not exsert, the upper directed downwards, molars $\frac{6-6}{6-6}$, tuberculate.

Sp. *Sus torquatus* Wagn., *Dicotyles torquatus* Cuv., Desm., Buff. *Hist. nat.* x. 3, 4, Schreb. *Säugth.* Tab. 325 (figure copied from Buffon's work), Tab. 325 A, *Dict. univ. d'Hist. nat., Mamm.* Pl. 10 B, fig. 1; South America and the most southern parts of the United States;—*Sus labiatus*, *Dicotyles labiatus* Cuv., *Dicotyles albirostris* Illig., Schreb. *Säugth.* Tab. 325 B, Maxim. *Abb. zur Naturgesch. Bras.* Lief. 15, Guérin *Iconogr., Mammif.* Pl. 38, fig. 1; South America. Both of these small species of hog live in the forests of the New World, and are, equally with the common hog introduced by Europeans, called by the *Guaranis, Tayazou;* hence the name of *Sus Tajacu*, by which Linnæus named, principally indeed, the first species, but also confounded the two. See on the anatomy Tyson *Phil. Trans.* 1683, p. 359, Daubenton in Buffon; on the dorsal gland in particular Seifert (under the presidence of Rudolphi) *Spicilegia adenologica*, Berolini, 1823, p. 10, Tab. II., and J. Mueller *De glandular. secern. structura*, p. 41, Tab. II. fig. 2.

Phacochœrus F. Cuv. All the feet tetradactylous. Tail short. A fleshy wart under each eye. Molar teeth various in number according to age, $\frac{3-3}{3-3}-\frac{5-5}{5-5}$, the last very long, composed of cylindrical tubes surrounded by enamel, closely conjoined; canines large, exsert, directed upwards and outwards. Incisors either $\frac{2}{6}$, or the lower only four, deciduous.

Sp. *Sus æthiopicus* L. (*Syst. nat. ed.* 12, III. p. 223), *Phacochœrus Pallasii* V. D. Hoev., Owen;—Vosmaer *Beschr. van het Afrikaansch breedsnuitig varken*, Amsterd. 1766, 4to (with a col. fig.), Pall. *Misc. Zool.* Tab. II. *Spic. Zool.* II. Tab. 1; without persistent incisors; at the Cape of Good Hope; the *Æthiopian Wart-hog.*—*Sus Æliani, Sus Africanus* Gm., *Phacochœrus Æliani*, Rueppell *Atl. zu der Reise im nördl. Africa*, 1826, Tab. 25, 26, Guérin *Iconogr., Mammif.* Pl. 38, fig. 2; with persistent incisors; in Abyssinia, at the coast of Guinea and in Mosambique; the *African Wart-hog.*—It was incorrectly supposed that the molars succeed each other here as in the elephant. There are originally three milk-molars and three permanent molars; of the first two molars that replace the milk-teeth (*præmolars*) the last persists, and of the unchangeable hind molars the hindmost alone remains. Owen has convincingly explained the dentition of these animals with his usual profundity[1].

[1] According to Cuvier (*Rech. s. les Ossem. foss.* II. 1, p. 124, *R. Ani.* I. p. 245) the two middle metacarpal and metatarsal bones in *Dicotyles* coalesce as in ruminants;

Comp. F. CUVIER *Mém. du Mus.* VIII. 1822, pp. 447—455, Pl. 32, J. VAN DER HOEVEN *Annot. de quibusd. Mammalium generibus, Nov. Act. Acad. Cæs. Leop. Carol.* XIX. 1, 1839, pp. 171—177, Tab. 18, R. OWEN *On the development of the molar teeth of the Wart-hogs, Philos. Trans.* 1850, Part 2, pp. 481—498, Pl. 33, 34.

Sus (recentiorum). Incisors $\frac{6}{6}$ or $\frac{4}{6}$, lower procumbent, canines exsert, directed upwards; molars $\frac{7—7}{7—7}$ or $\frac{5—5}{5—5}$, tuberculate. Feet all tetradactylous. Tail short.

Sp. *Sus larvatus* F. CUV., *Mém. du Mus.* l. l. Pl. 22, SCHREB. *Säugth.* Tab. 327 A; Southern and South-eastern Africa, Madagascar; *boschvarken* at the Cape of Good Hope;—*Sus scropha* L., SCHREB. *Säugth.* Tab. 320, CUV. *R. Ani., éd. ill., Mammif.* Pl. 79, fig. 1; the wild hog lives in the forests of Asia and Europe (not in Great Britain, Sweden, or Denmark); from this species descends our tame hog[1], an exceedingly voracious and prolific animal, bringing from ten to fourteen young ones at a litter. Near Upsal a single-hoofed variety occurs, which is said to be also met with in Hungary. Comp. on this animal LINDH in LINN. *Amœn. Academ.* V. pp. 461—483. In the Moluccan Archipelago different species of this genus occur: *Sus verrucosus* BOIE at Java, *Sus vittatus* BOIE at Java and Sumatra, *Sus barbatus* MUELLER at Borneo. Comp. *Verh. over de Overzeesche Bezittingen, Zool., Mamm.*—*Sus barbatus* and *verrucosus* have a skull of great length and narrow forwards[2]. Some distinguish as a separate sub-genus *Babirussa* F. CUV. (*Porcus* WAGL.), with four incisors in the upper jaw and $\frac{5—5}{5—5}$ molars. To it belongs a species, *Sus Babyrussa* L., BUFF. *Suppl.* III. Tab. 12, SCHREB. *Säugth.* Tab. 328, GEOFFR. ST.-HIL. *et* F. CUV. *Mammif.*, Livr. 64, CUV. *R. Ani., éd. ill., Mammif.* Pl. 79, fig. 2; *het hertzwijn*, the *stag-hog;* on some easterly islands of the Indian Archipelago, *Boeroe, Celebes,* not in Borneo. In the male the canines of the upper jaw are very large and curved backwards. Comp. on the anatomy of this species W. VROLIK *Nieuwe Verh. der Eerste Kl. van het Koninkl. Nederl. Instituut,* X. 1844, bl. 207—248, with plates. (The large parotid gland which extends over the neck is remarkable.)

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in the three skeletons which I have examined I have not found this statement confirmed; these bones have coalesced at their superior extremity alone.

[1] "*In nullo genere æque facilis mixtura cum fero.*" PLINIUS *Hist. nat.* Lib. VIII. c. 53. So also EICHWALD relates that the wild hogs in *Lithuania* often get into the sties to copulate with the tame ones; the young pigs, which are the produce, are wild and intractable. *Naturhist. Skizze von Litthauen, Volhynien und Podolien,* Wilna, 1830, 4to, s. 244.

[2] A small species from Nepaul, described by HODGSON under the name of *Porcula Salvania* (*Proceed. Zool. Soc.* 1847, p. 115), has incisors which do not project outside the jaw, but in other respects all the characters of the genus *Sus*.

Family XVI. *Hippopotamina.*

Hippopotamus L. Incisors $\frac{4}{4}$, the lower procumbent, horizontal, with the middle longer; canines large, worn obliquely into a very smooth surface at the back part; molars $\frac{7-7}{7-7}$ or in adults $\frac{6-6}{6-6}$; tuberculate, complex, posterior four large. Feet short, tetradactylous, with short hoofs. Body obese, covered with skin nearly naked. Tail short.

Sp. *Hippopotamus amphibius* L., BUFF. *Hist. nat., Suppl.* Tome VI. Pl. 4 (copied in SCHREBER, Tab. 318), Pl. 5, SMITH *Illustr. of the Zool. of South Africa, Mamm.* Pl. 6, CUV. *R. Ani., éd. ill., Mammif.* Pl. 78, fig. 1; the *river-horse, das Flusspferd,* known also amongst the colonists of the Cape of Good Hope by the name of *Zeekoe;* a very heavy and sluggish animal, attaining a length of more than eleven feet; it resides by preference in rivers, sometimes also in the sea, and lives solely on plants, especially grass. This animal, which was formerly met with in Egypt, now lives nowhere more northward than Abyssinia, but further south throughout the whole of Africa. There seems to be no distinct difference observable between the Abyssinian Hippopotamus and that of South Africa. On the Osteology see CUVIER *Ann. du Mus.* V. pp. 299—328. Some notices upon the stomach and its three divisions, on the intestinal canal of nearly twelve times the length of the body, without cœcum, and on some other viscera, were given not long ago by PETERS *Rise nach Mossambique, Säugth.* s. 180, 181. A smaller species from West Africa has been described by MORTON as *Hippopotamus minor,* and afterwards as *Hipp. liberiensis, Journal of the Acad. of nat. Sc. of Philadelphia,* Sec. Ser. I. 1850, pp. 231—239, Pl. 32—34. On the Osteology of this species comp. JOSEPH LEIDY, ibid. II. 1854, pp. 217—224, Pl. 21. Amongst other osteological peculiarities there are only two incisors in the lower jaw. It was proposed to make a new genus of it under the name of *Chœropsis,* which seems unnecessary.

Different fossil species of this genus are known from the tertiary strata and the diluvial period; amongst these last is *Hippopotamus major* CUV., of which many remains have been found in France, Italy and elsewhere. Compare CUVIER *Rech. s. les Oss. foss.* I. pp. 304—334, and PICTET *Palæontol.* I. p. 320—322.

ORDER V. *Ruminantia.*

Feet bisulcate, with two toes insistent, ungulate; two supplementary hoofs in many. Molar teeth complex, upper incisors mostly none, lower eight, more rarely six; canines mostly none. Four stomachs, or in some three. Metacarpal and metatarsal bone single, bipartite below. Other characters of the Artiodactyles.

Ruminant or *bisulcate animals.* Of rumination and the compound stomach we have already treated above (p. 579). In this order we find the animals of greatest utility to man, and of which the possession forms the principal riches of many races of people.

Compare on this order: C. J. SUNDEVALL *Methodisk öfversigt af idislande djuren,* LINNE'S *Pecora; K. Vetensk. Akad. Handl.* 1844, pp. 121—210, Pl. 13, 14, 1845, pp. 265—280. (Translated into German by HORNSCHUCH in his *Archiv skandinavischer Beiträge zur Naturgesch.* 2ter Theil, Greifswald, 1847, s. 78—160, s. 261—320; also published separately, *Methodische Uebersicht der wiederkäuenden Thiere.*)

Family XVII. *Tylopoda* ILLIG. Feet callous beneath, with sole not divided, didactylous, with supplementary hoofs none. Hoofs imperfect, covering the upper surface of digits only. Horns none. Incisors $\frac{2}{6}$; canines in both jaws.

The camels of the Old, and the lamas of the New World form a small group very distinctly separate from the rest of the *ruminantia* as well by their hoofs as by the possession of incisor teeth in the upper jaw. These teeth are placed at the side of the intermaxillary bone close to the canines, and agree with them in form. In the presence of six incisors only in the lower jaw, in the lower jaw being undivided, and in other peculiarities, chiefly osteological, the camels form, in some sense, the transition from the ruminants to the solidungulates; see CUVIER *Ménag. du Mus.* éd. 8vo, 1. p. 31, MECKEL *Archiv für die Physiol.* VIII. s. 1—20. In this circumstance also is the camel similar to the horse and not to the rest of the ruminants that no *cotyledones* are present, but the vascular villi are dispersed over the whole of the chorion.

Camelus L. (Characters of the family. Upper lip cloven; neck very long.)

Camelus CUV., ILLIG. Molar teeth $\frac{6—6}{5—5}$, with first remote from the rest, resembling a canine in form. Toes conjoined underneath nearly to the apex. Back with a single adipose hump, or with two. Ears short, obtuse.

Sp. *Camelus dromedarius* L., BUFF. XI. Pl. 9; *Ménag. du Mus.* éd. 8vo, 1. pp. 126—139, with figure; GUÉR. *Iconogr., Mammif.* Pl. 41, fig. 2, *Dict. univ. d'Hist. nat., Mammif.* Pl. 12; the skeleton in PANDER u. D'ALTON *Skelete der Wiederkäuer,* Tab. 3; the *camel* or *dromedary* (*Camelus arabicus* ARISTOT. *de Hist. Anim.* Lib. II. cap. 2); one hump on the back. In front of the soft palate is situated a duplicature of the mucous membrane,

which in males becomes highly vascular during the rutting season, and often comes to view from the mouth between the canine and the molars. (RUDOLHI'S *Physiol.* II. 2, s. 84, MAYER'S *Analecten zur vergl. Anat.* 2te Sammlung, Bonn, 1839, s. 42—44). Compare on the anatomy G. H. RICHTER *Analecta ad anatomen Cameli dromedarii spectantia*, Regiomonti, 1824, 8vo.

Camelus bactrianus L., BUFF. XI. Pl. 22, *Ménag. du Mus.* I. pp. 31—41 (with fig. copied in CUV. *R. Ani., éd. ill, Mammif.* Pl. 85, fig. 1); the *two-humped camel*, already named by ARISTOTELES *Camelus bactrianus* (l. l.). Compare FR. MUELLER and C. WEDL *Beiträge zur Anatomie des zweibuckeligen Kamecles*, Mit 5 lith. Tafeln, Wien, 1852 (printed separately from the 3rd Vol. of the *Denkschr. der math.-naturw. Cl. der Kaiserl. Akad. der Wissenschaften*).

Camel (in Greek ἡ (and ὁ) κάμηλος) is a name borrowed from the languages of the East, *Gamal* Hebr., *Gimal* or *Jemal* Arabic. These animals feed on dry and prickly plants, are moderate, and drink seldom. They are rapid in their course and bear large burdens (from 600 to 1000 pounds). Hence they are of inestimable service in the great deserts which extend from Arabia, through Africa to the Atlantic Ocean, where no fresh plant cools, no fountain gives fertility, and the wind acting on the dry whirlpools produces the effect of an interminable ocean of sand. The *ship of the desert* is with great propriety the name which the Arabians have given this useful animal.

These animals endure a pretty moderate climate, especially the two-humped camel, which is dispersed over Asia up to high latitudes. That with a single hump lives chiefly in Arabia and Egypt in the country of the date-palms. There is at Pisa a stud of single-humped camels, which has been maintained since the middle of the seventeenth century. No longer are they found anywhere in a wild state. The two species breed together, producing a spurious offspring, which again is sometimes prolific like the mule.

Auchenia ILLIG., *Lama* CUV., *Lacma* TIEDEM. Molar teeth $\frac{5—5}{4—4}$. Back without hump. Sole cloven as far as the middle of fore-part. Ears somewhat long, acuminate.

The *lamas*, which represent the camels in the New World, live together in troops on the mountains of Chili and Peru. They are much smaller than camels. Compare on the anatomy especially C. CHRISTEN *Diss. inaug. sistens de Lama observationes nonnullas anat.*, Tubingæ, 1827, 8vo, and J. F. BRANDT *Beiträge zur Kenntniss des Baues der innern Weichtheile des Lama, Mém. de l'Acad. impér. des Sc. de St-Pétersbourg*, VI. Série, Tome IV. Mit 17 Steintafeln, St. Petersburg, 1841, 4to.

Sp. *Camelus glama* L., *Auchenia lama* BRANDT, WAGN. (and *Auchenia huanaco* auct.[1]) BUFF. *Suppl.* VI. Pl. 27 (cop. in SCHREB. *Säugth.* Tab.

[1] Here also is usually referred as a race or variety the *Alpaca, Camelus Pacos* L.; VON TSCHUDI, on the other hand, adopts four species: *Auchenia lama, A. Huanaco, A. Alpaco* and *A. Vicunia.*

306), MEYER *Nov. Act. Acad. Cæs. Leop. Carol.* XVI. p. 552 sqq. Tab. 40 (cop. in CUV. *R. Ani., éd. ill., Mammif.* Pl. 85, fig. 2);—*Camelus vicugna* GM., BUFF. *Suppl.* VI. Pl. 28, TSCHUDI *Faun. Peruan.* Taf. 17.

Family XVIII. *Elaphii.* Feet with the sole of each toe distinct, included entirely within the margins of the hoof. Incisor teeth $\frac{0^1}{8}$, canines none or only the upper, molars $\frac{6-6}{6-6}$. Horns in some none, in some osseous, without a horny covering.

A. *Feet furnished with supplementary hoofs.*

Moschus L. (*Tragulus* BRISS.) Canine teeth in upper jaw, exsert in males, long. Lachrymal sinuses none. Horns none. Tail short or very short.

Sp. *Moschus moschiferus* L., PALLAS *Spic. Zool.* Fasc. XIII. 1779 c. Tab. (fig. of animal copied in SCHREB. *Säugth.* Tab. 242), BRANDT *u.* RATZEBURG *Mediz. Zool.* I. s. 41—51, Tab. 7, 8, II. s. 347, 348 (with another fig. of animal); the *musk-deer.* The size is that of a young roe; colour brown with white throat and a white streak on each side of the neck, and, often inconspicuous, whitish-grey spots along the sides at the back part of the body; the hairs are stiff, flat, and with the edges sinuous. The male has a glandular sac in the neighbourhood of the navel, in which the musk is secreted at the adult period of life. The musk-deer lives on the high plains of central Asia, and is dispersed as far as the East of China.

Smaller species with shorter ears and smooth hair, of which the legs are slim, with the supplementary hoofs at a greater distance from the ground, are also distinguished by the absence of the musk-sac. They occur in the South of Asia, at Ceylon and in the Sunda Islands. Sub-gen. *Tragulus* (BRISS.) SUNDEV. (*Tragulus* and *Meminna* GRAY). Sp. *Moschus javanicus* GMEL. (from PALLAS), *Moschus Kanchill,* SCHREB. *Säugth.* Tab. 245 c, &c. (The genus *Moschus* scarcely differs from that of the Deers; less at least than the giraffe, which LINNÆUS united with them.)

Cervus L. (excl. of *Camelopardalis*). Upper canine teeth in many. Horns cast annually, peculiar to males (in females none, one species excepted). Sebaceous gland (*sinus lachrymalis*) in front of eye. A tuft of longer hair at the hind feet in most. Tail short, sometimes very short.

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[1] In the embryo of the *Cervidæ* (fallow-deer) OWEN, *Odont.* p. 540, discovered six deciduous incisors in the upper jaw, as J. GOODSIR, *Report of Brit. Assoc.* 1839, had previously in the *cavicornia* (cow and sheep). Thus the deciduous series of teeth in *ruminantia* is, incisors $\frac{6}{6}$, canines $\frac{1-1}{1-1}$, molars $\frac{4-4}{4-4}$.

The *Deers* live principally in forests, as well in the Old as the New World, and in very different climates; from Africa, however, only one species is known; from Australia not one. Some species run with speed, and so lightly that the beat of their foot upon the ground is scarcely heard, but, especially when many are in company, an incessant rattle of the joints of their thin legs or a peculiar cracking, as in the reindeer.

The horns of the deer are bony excrescences which are developed on a cylindrical process of the frontal bones (the so-named *Rosenstocke*). This process is covered with skin and hair; it appears, shortly after birth, as an *epiphysis* upon the skull, with which it speedily coalesces. With this rose-stock (the non-deciduous part of the horn) the horns of the giraffe beyond doubt correspond. At the point of the rose-stock is developed, after the second year, the horn which is shed annually. The growth of the horns proceeds rapidly, so that in a few weeks they attain their full size. At first they are covered by a woolly investment, a prolongation of the skin; afterwards the skin dies and falls from the horns in shreds; many refer this death of the skin to the development of a knotted ring (the *Rosenkranz*), which, as the growth of the horn proceeds, is forming at its base above the rose-stock, and which knots compress the vessels of the skin and so interrupt the course of the blood. Afterwards a separation begins above the rose-stock; the horns become loose and at last fall off.—The females, with the exception of the reindeer, have no horns; but in old females they are observed sometimes, just as we stated above (p. 362) that hen-birds at a very advanced age occasionally assume the plumage of the male. When stags are castrated the horns are not developed, or if they had been developed before the operation they are not cast any more[1]. Finally the casting of the horns in cold and temperate countries occurs at determinate periods, which differ for different species; in tropical countries (South America, East Indies) the casting of the horns is less regular.

Compare G. SANDIFORT *Over de vorming en ontwikkeling der horens van zogende dieren, in het bijzonder van die der hertenbeesten; Nieuwe Verhand. van de Eerste Klasse van het Koninkl. Nederl. Instituut*, II. 1827, with many figures.

On the genus of the deers compare CUVIER *Rech. s. les Oss. foss.* IV. 3ième édit. pp. 23—69; *des cerfs vivans;* DUCROTAY DE BLAINVILLE *Journal de Physique*, Tome 94, pp. 254—284, 1823; HAMILTON SMITH in GRIFFITH *Animal Kingdom*, Tom. V. 1827, PUCHERAN *Monographie des espèces du genre Cerf*, avec 8 pl., *Archives du Mus.* VI. 1852, pp. 265—492. Most of the species are when young ruddy-brown with white spots, a colour which in *Cervus Axis* ERXL. from Bengal (BUFF. XI. Pl. 28, 29, *Ménag. du Mus.* II. éd. 8vo, pp. 99—100, fig. of female) persists for the whole life.

Sp. *Cervus Alces* L., SCHREB. *Säugth.* Tab. 246 A, B, C, D, *Dict. univ. d'Hist. nat., Mammif.* Pl. 11 bis, fig. 2, CUV. *R. Ani., éd. ill., Mammif.* Pl. 87,

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[1] LINNÆUS indeed says of the reindeer, "*castratus quotannis cornua deponit.*" *Syst. nat.* I. ed. 12, p. 93. This is maintained by SUNDEVALL also, in opposition to the denial of later writers.

fig. 1; the *elk*, the largest species of this genus, equalling almost the horse; the tail is short, legs high, flat broad horns, large and palmated. This species is found in the north of both hemispheres, in Russia, Poland, Sweden and Norway, but not in Lapland in the high North; (the reindeer begins to appear where the residence of the elk ceases).—*Cervus Tarandus* L., BUFF. *Suppl.* III. Pl. 18 bis, SCHREB. *Säugth.* Tab. 258 C, D, CUV. *R. ani., éd. ill., Mammif.* Pl. 87, fig. 2; the *reindeer;* the horns, which form many branches terminating broad at the extremity, occur in both sexes; they are smaller in the female; the hoofs are broad and flat; the throat has long, dependent hairs. The reindeer lives on dried leaves, and especially on the reindeer-moss (*Lichen rangiferinus* L.); it forms the chief wealth of the Laplanders, who by means of it supply all their wants of food, clothing and furniture; every well-appointed family of Laplanders possesses at least 300 head of reindeer. The skulls of this species often present remarkable differences[1]. Compare on the reindeer C. F. HOFFBERG in LINN. *Amœn. Acad.* IV. pp. 144—168, and P. CAMPER *Natuurk. Verhandelingen*, Amsterdam, 1782 (*Œuvres de* P. CAMPER I. pp. 291—353), SCHREBER *Säugth.* V. S. 1028—1074.—*Cervus Dama* L., BUFF. VI. Pl. 27, 28, SCHREB. *Säugth.* Tab. 249, BONAP. *Faun. Ital.* I., *Mammif.* Pl. 6, *Dama platyceros;* the *fallow-deer;* the male with branched horns, flattened and palmate above; the winter-coat brown one-coloured, the summer-coat ruddy with white spots, the tail longer than in most of the deer, black above, white below; in the South of Italy, Sardinia, Spain, North Africa, at Tunis, &c.; now dispersed over many countries, especially of the South of Europe.—Numerous are the species with cylindrical horns: *Cervus Elaphus* L., BUFF. VI. Pl. 9, 10, 12, SCHREB. *Säugth.* Tab. 247, BRANDT u. RATZEBURG *Mediz. Zool.* I. Tab. VI. CUV. *R. Ani., éd. ill., Mammif.* Pl. 88, fig. 2; the *stag, le cerf commun, der Edelhirsch;* in the forests of Europe and Asia;—*Cervus capreolus* L., BUFF. VI. Pl. 32, 33, SCHREB. *Säugth.* Tab. 252, CUV. l. l. fig. 1; the *roe, roe-deer, le Chevreuil, das Reh;*—*Cerv. virginianus* GM., SCHREB. *Säugth.* Tab. 247 H, GUÉR. *Iconogr., Mammif.* Pl. 42, fig. 3.—On the Sunda Islands a small species is found with large rose-stocks and small horns, which has canines in the upper jaw projecting from the mouth in the male; there are no tufts of hair (*scopæ*) at the hind feet: *Cervus Muntjac* ZIMMERM., GMEL., HORSF., *Zool. Research.* No. VI. The same or a nearly allied species also occurs in Bengal (*Chevreuil des Indes* ALLAMAND, BUFF. *Suppl.* VI. Pl. 26, *Cervus stylocerus* WAGN. in SCHREB. *Säugth.*). On these species rests the sub-genus *Cervulus* BLAINV.

In the newer tertiary and diluvial deposits different species of deer have been discovered; amongst these is *Cervus giganteus* BLUMENBACH, *Megaceros hibernicus* OWEN; the distance between the points of the horns in this deer is eight feet or more. See CUV. *Rech. s. les Oss. foss.* IV. pp. 70—88, OWEN *Brit. foss. Mamm.* pp. 444—468. (Certain skulls which have been since found shew that the horns were absent in the female.)

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[1] Compare W. VROLIK *Over eene vermoedelijk tweede soort van Rendier, met afbeeldingen; Nieuwe Verh. van de Eerste Klasse van het Koninkl. Nederl. Instituut*, II. Deel.

B. *Feet without supplementary hoofs.*

Camelopardalis BODD., SCHREB., GMEL. (spec. of *Cervus* L., *Giraffa* BRISS.). Canines none. Two frontal horns in both sexes, conical and truncated, short, covered with hairy skin, persistent. Neck very long. Fore feet longer than hind feet. Tail moderate, with extremity setose.

Sp. *Camelopardalis giraffa* GMEL., *Cervus Camelopardalis* L., VOSMAER *Beschrijving van het Kameelpaard*, 1787, with fig., GEOFFR. SAINT-HILAIRE *et* F. CUVIER, *Mammif.*, Livr. 61, *Ann. des Sc. nat.* Tome XI. 1827, Pl. 22, GUÉRIN *Iconogr., Mammif.* Pl. 45, CUV. *R. Ani., éd. ill., Mammif.* Pl. 89; the skeleton in PANDER *u.* D'ALTON l. l. Tab. I. II.; the *giraffe* is the tallest of the mammals; when standing up the height from the vertex to the hoof of the forefoot is from 16 to 18 feet. The colour is light yellow, with large, red-brown spots. The horns continue for a long time as distinct *epiphyses;* a broad swelling at the fore part of the frontal bones, which increases with age, has been incorrectly described as a third horn. The tongue is long and possessed of great mobility; it is used by the animal to strip from trees the leaves on which the giraffe feeds; these are principally of the *Mimosæ*. Besides this it grazes, without kneeling, with the fore feet widely straddling. In its flight it gallops with the fore legs stiff in rising and falling; at other times it has an ambling gait. The period of gestation is 14 months, and the young is very large at the time of birth. The giraffe is found in Nubia and Abyssinia, also in South Africa. This animal was known to the ancients and had been brought sometimes to Rome, PLINIUS, Lib. VIII. c. 18.

See on the anatomical peculiarities OWEN *Notes on the Anatomy of the Nubian Giraffe, Transact. of the Zool. Soc.* II. 3, 1839, pp. 217—248, Pl. 40—45; the same *On the birth of the Giraffe at the Zool. Gardens*, ibid. III. 1, 1842, pp. 21—28, Pl. 1, 2; SEBASTIAN *Aanteekeningen by het ontleden van eene Nubische Giraffe, Tijdschr. voor natuurl. Gesch. en Physiol.* XII. 1845, bl. 185—224, Pl. II.; JOLY *et* LAVOCAT *Recherches hist., zool., anat. et paléontologiques sur la Giraffe, Mém. de la Soc. d'Hist. nat. de Strasbourg*, III. 3 Livr. (1846), pp. 1—124 av. 17 Pl. The giraffe has, as LINNÆUS indicated by his arrangement, the closest affinity with the deers, although in some respects it approaches the antelopes.

In the neighbourhood of this genus is usually placed the *Sivatherium*, CAUTLEY and FALCONER, of which the remains were discovered in Sevalik, a branch of the Himalayan mountains.

Family XIX. *Cavicornia.* Incisor teeth $\frac{0}{8}$[1], canines none, molars $\frac{6-6}{6-6}$. Horns in both sexes or only in males, composed

[1] [See note p. 646. The outer incisors in the lower jaw are representatives of canines, as shewn by the analogy of the camels, by the lateness of their development, and by their frequent peculiarity of form. OWEN *Odontogr.* p. 540.]

of an osseous nucleus and a horny sheath, persistent. Accessory hoofs in several.

The *hollow-horned Ruminants.* In this family the horns consist of a bony core and a horny case which covers the bone. The horny investment is produced by a papillary layer (as *matrix*) on the core (which under this layer is covered by corium and periosteum). Here grow the hairs, which concreting into horny substance, form annually a new ring. In various species of Antelope the bony nucleus has no internal cavity; in others, in the ox and goat genera the nucleus is hollow internally and the cavities are in connexion with the frontal sinuses. The first horny case, which is hairy, shreds off in the second year; after this the horns become smoother. Compare on these horns SANDIFORT in his work cited above, pp. 14—19, and especially A. NUMAN *Bijdrage tot de ontleedkundige en physiologische kennis der horens van het Rundvee, Nieuwe Verhandelingen der Eerste Klasse van het Koninkl. Nederl. Instituut,* XIII. Dl. 3e Stuk, 1847; see also G. VROLIK *Over het verschil van de inwendige gesteldheid der horenfritten bij Antilopen, Verhandelingen der Koninklijke Akademie,* I. 1853.

All the animals of this family form, as appears from their teeth and their whole structure, only a single large natural group, of which LINNÆUS distributed the species known to him amongst the genera *Bos, Capra* and *Ovis.* Afterwards PALLAS separated the antelopes from the genus *Capra, Miscell. Zool.* pp. 1, 2. The antelopes now form the most numerous division of the entire order. In this family of ruminants the gall-bladder is present, which is wanting in the deers.

On the arrangement OGILBY (*Transact. of the Zool. Soc.* Vol. III. Pt. I. 1842, pp. 33—36), J. E. GRAY (*Ann. and Mag. of nat. Hist.* Vol. 18, 1846, pp. 227—233) and TURNER (ib. Sec. Ser. Vol. 8, 1851, pp. 409—425) have treated; comp. also SUNDEVALL op. laud.

Dicranocerus HAMILTON SMITH, *Dicranoceras* WIEGM., *Antilocapra* ORD. Horns in males compressed at the base, curved at the point, with accessory branch porrect, subulate above the base; in females tubercles instead of horns. Lachrymal sinuses none. Accessory hoofs none. Tail short.

Sp. *Dicranocerus furcifer, Antilocapra americana* ORD, *Cervus hamatus* BLAINV., HAMILTON SMITH *Transact. of the Linn. Soc.* XIII. 1822, p. 28, Tab. II., RICHARDSON *Faun. boreali Amer.* I. pp. 261—268; of the size of a goat, colour grey-yellow; the hair is dry and stiff, like that of a deer, with which this animal in the tail also and even in the horns shews some correspondence; it lives in large plains of North America up to 53° N. L; the *prong-horned antelope.*

Antilope PALL. (in part). Horns in both sexes or in males only, variously bent, annulate or folded at the base, towards the point round, smooth. The osseous nucleus sometimes solid.

Lachrymal sinuses in many. Supplementary hoofs in most. Eyes at the upper margin of forehead, remote from the nasal apertures, with head protracted forwards. Ears near the nape, mostly long.

The species of Antelopes are peculiarly numerous in Africa. Comp. on this genus PALLAS *Spic. Zool.* I. pp. 1—16, and Fasc. XII., LICHTENSTEIN *Ueber die Antilopen des nördlichen Africa, besonders in Beziehung auf die Kenntniss welche die Alten davon gehabt haben. Abhandl. der Akad. der Wissensch. zu Berlin a. d. Jahre* 1824, Berlin, 1826, s. 194—240, with fig.; LAURILLARD *Dictionn. univ. d'Hist. nat.* I. (1841) pp. 612—626, J. E. GRAY *Synopsis of the species of Antelopes, Annals of nat. Hist.*, Sec. Ser. Vol. 8, 1851, pp. 129—146, 211—228.

Various attempts have been made to separate this numerous genus into subordinate divisions, or even to resolve it into different genera. The last would be to be preferred, but it appears to me, after a comparative review of the species, to be scarcely practicable, since although there be great difference in *habitus*, still intermediate forms constantly present themselves, and the characters moreover are of very inferior interest and importance[1]. Many species present external resemblance to the deers, others to the goats, some to the oxen, some even to the asses.—In all instances the eyes are placed much higher and more backwards in the antelopes than in the deers, and the base of the horns is mostly placed forwards almost over the margin of the orbit. The nasal bones are in most species much elongated.

† *With upper lip sulcate, hairy.*

Bubalus veterum, *Acronotus* HAM. SMITH. Head narrow, protracted. Horns nearly contiguous at the base, soon divergent, then converging, with the subulate apex bent backward, common to both sexes. Ears acuminate, long. Back convex, with shoulders high. Tail moderate, setose. (Lachrymal sinuses small. Two mammæ.)

Sp. *Antilope Bubalis* PALL. (in part), CUV., *A. mauritania* OGILBY, BUFF. *Suppl.* VI. p. 14, *Ménag. du Mus.* Livr. 5 (éd. 8vo, I. pp. 346—355); of the size of an ass, one-coloured purplish-russet; from the North of Africa; known to the ancients, (PLINIUS VIII. c. 15, &c.,) the *cervine antelope*—*Antilope Caama* CUV., BUFF. *Suppl.* VI. Pl. 15, CUV. *R. Ani., éd. ill., Mammif.* Pl. 92, fig. 1 (figure moderate, body too long), SMITH *Illustr. of the Zool. of S. Afr., Mamm.* Pl. 30; very similar to the preceding, but chestnut-brown with black forehead and black tail; the *hartebeest* of

[1] This is chiefly true of the presence or absence of horns in the female; a character that appears to have no value, and, even if it had, could not well be employed in the arrangement.

the Cape colonists;—*Antilope lunata* HAM. SMITH, SMITH *Illustr.* Pl. 31; —*Antilope pygargus* PALL., HOUTTUYN *Nat. Hist.* I. 3, Pl. 24, fig. 2, SCHREB. *Säugth.* Tab. 273; the *white-faced Antelope;* these three species are from South Africa.

Gazella HAM. SMITH. Body narrower forwards, scarcely protracted. Horns lyrate, approximate at the base, annulate, almost always common to both sexes. Ears acuminate, long. Back even. Tail short or moderate. Lachrymal sinuses distinct. Two mammæ.

Sp. *Antilope euchore* FORST., BUFF. *Suppl.* VI. Pl. 21, VOSMAER *Beschrijving van eene nieuwe soort van hartebok,* Amsterd. 1784; the *pronkbok* of the colonists at the Cape of Good Hope, the *springer;*—*Antilope dorcas* PALL., *Capra Dorcas* L., BUFF. XII. Pl. 23; the *gazelle;* lives in large troops in North Africa, and is the chief prey which is hunted by the lions in those countries;—*Antilope Dama* LICHTENST., l. l. Tab. 3, 4; cream-coloured, neck and fore part of the back ruddy; a white spot on the throat. This species lives in Nubia and Kordefan; closely resembling it is the *Ant. Dama* of PALL., BUFF. XIII. Pl. 32, from Senegal, from which the *Ant. Mhorr* BENNETT, *Transact. of the Zool. Soc.* I. pp. 1—8, Pl. 1, from Morocco, scarcely differs.

(Add sub-genus *Lepticeros* WAGN. with horns substraight, long.)

Antilope HAM. SMITH. Horns annulate, with rings exsert, the tip smooth, turned in a spiral, approximate at the base in males only. (A sub-genus scarcely distinct from the preceding; aberrant forms.)

Sp. *Antilope cervicapra* PALL., *Capra cervicapra* L., PALL. *Spic. Zool.* I. Tab. 1, BUFF. *Suppl.* VI. Pl. 18, 19, BENNETT *Gardens and Menag. of the Zool. Soc.* I. p. 117, the *Indian antelope;* the male has elegant horns twice bent, with the points standing far apart; this species is found in countries to the west of India up to the Indus;—*Antilope melampus* LICHTENST., SCHREB. *Säugth.* Tab. 274; a beautiful species from South Africa, of a ruddy colour, distinguished by the absence of subsidiary hoofs.

Note.—Aberrant forms with small ears. Tail short or very short.

Sp. *Antilope gutturosa* PALL., *Spic. Zool.* XII. Tab. 2. In the Caucasus.

Sub-genus *Pantholops* HODGS. Sp. *Antilope Hodgsonii* ABEL, from the mountains of Thibet, with woolly fleece, and slender legs; lachrymal sinuses none. Horns very long, with point acute, smooth. Tail very short.

Sub-genus *Colus* WAGN. Sp. *Antilope Saiga* PALL., *Capra tartarica* L., PALL., *Spic. Zool.* XII. Tab. 1; with head deformed, nose tumid, convex, very large. Lives in Siberia and even in Russia as far as Poland.

Tragelaphus BLAINV., WAGN. Horns contorted, carinate, directed backwards in males only. Lachrymal sinuses none. Ears acuminate, long. Supplementary hoofs small. Tail moderate. Mammæ four.

Sp. *Antilope strepsiceros* PALL., BUFF. *Suppl.* VI. Tab. 13, VOSMAER *Beschr. van de Condou*, Amst. 1783, SMITH *Illustr. of the Zool. of S. Afr., Mamm.* Pl. 42, 43; the *Koodoo* or *striped antelope*;—*Antilope scripta* PALL., BUFF. XII. Pl. 40, *Dict. univ. d'Hist. nat., Mammif.* Pl. 11, fig. 1; the *harnessed antelope;* coast of Guinea, Senegal;—*Antilope sylvatica* SPARM., BUFF. *Suppl.* VI. Pl. 25; *boschbok* of the colonists at the Cape of Good Hope, &c.

Cervicapra BLAINV., SUNDEV., *Redunca* HAM. SMITH. Horns annulate in males only, erect, towards the tip bent forwards, round. Mammæ four.

a) *With lachrymal sinuses none.*

Sp. *Antilope redunca* PALL., BUFF. XII. Pl. 46, Senegal;—*Antilope ellipsiprymnos, Kobus ellipsiprymnus* SMITH *Illustr., Mamm.* Pl. 28, 29, the *waterbok;* a beautiful species from South Africa, &c.

b) *With lachrymal sinuses arched, transverse.*

Calotragus SUNDEV., TEMM. (Horns subulate, scarcely bent forwards, short. Tail very short.)

Sp. *Antilope tragulus* FORST.;—*Antilope scoparia*, &c.

Note.—Here also, as it seems, ought to be placed a Bengal species of which the male is furnished with four horns, the anterior very short, conical, the posterior longer, subulate, erect: *Antilope quadricornis* BLAINV., *Antilope Chiharra* HARDWICKE, *Linn. Trans.* XIV. Pl. 15 A, B. HILL ibid. XV. pp. 501—505, Pl. 19 (20); GEOFFR. SAINT-HIL. *et* F. CUV. *Mammif.* Livr. 44.

Sylvicapra OGILBY, SUNDEV. Horns subulate, conical, short, reclined, distant at the base, either in both sexes, or in males only. Tail very short. Mammæ four.

a) With vertex furnished with long hair. Oblique striæ or a round pit in place of lachrymal sinus, in front of eyes.

Cephalolophus WAGN., *Cephalophus* HAM. SMITH, *Sylvicapra* SUNDEV.

Sp. *Antilope mergens* BLAINV.,—*Antilope natalensis* HAM. SMITH;—*Antilope Maxwelli* HAM. SMITH, &c.—(On the synonymy of *Ant. Grimmia* PALL., cons. TEMMINCK *Esquisses zool. sur la cote de Guiné*, pp. 224 sqq.)

Antilope Hemprichiana EHRENB., *Antilope saltiana* CRETSCHMAR, SCHREB. *Säugth.* Tab. 260 C. (Sub-genus *Neotragus* HAM. SM., WAGN.); Abyssinia.

b) With vertex without long hair. Lachrymal sinuses and supplementary hoofs none. (*Nanotragus* SUNDEV., sp. of *Neotragus* HAM. SM., WAGN.)

Sp. *Antilope spinigera* TEMM.; from the coast of Guinea; the young animal was described by LINNÆUS under the name of *Moschus pygmæus*, as stated by TEMMINCK; see a fig. of this in GUÉRIN *Iconogr., Mammif.* Pl. 42, fig. 1; comp. SUNDEVALL *Ofvers. af Kongel. Akad. Forh.* 1846, pp. 83—87.

Hippotragus SUNDEV., *Ægocerus* HAM. SM. Horns annulate, large, inserted over the eyes, recurved. Lacrymal sinuses none. (Large species, with neck maned. Tail moderate, setose; nose subconcave.) Horns of females less. (Sometimes none?)

Sp. *Antilope leucophæa* PALL., BUFF. *Suppl.* VI. Pl. 20, SCHREB. *Säugth.* Tab. 278; the *blaauwe bok* of KOLBE; a very rare species, extinct in some districts of South Africa; the individual figured by ALLAMAND in the Dutch edition of BUFFON and copied in the French loc. cit., has now been transferred from the collection of the *Haarlem Maatschappij van Wetenschappen* to the Museum at Leyden;—*Antilope equina* GEOFFR., SMITH *Illustr., Mamm.* Pl. 27;—*Antilope Harrisii, Aigocerus niger* HARRIS *Trans. of the Zool. Soc.* II. 3; 1839, Pl. 39, pp. 213—215. Species from South Africa to the north of the Colony at the Cape.

†† *With upper lip ample, broad, not sulcate.* (In all four mammæ.)

Hippelaphus (from ARISTOT.), *Portax* HAM. SMITH. Horns short, recurved. Lachrymal sinuses. Neck short. Tail long, tufted. Back short, declivous, with shoulders higher.

Sp. *Antilope picta* (and *Tragocamelus*) PALL., HUNTER *Philos. Trans. for the year* 1771, Pl. 5, BUFF. *Suppl.* VI. Pl. 10, 11, BENNETT *Gardens and Menag. of the Zool. Soc.* I. p. 125; the *Nylghau*, of a dark colour especially under the belly, from the continent of India, with a bunch of long, black hair under the neck. (SUNDEVALL states that the female also is horned, perhaps exceptionally only or when of a great age.)

Oreas DESM. (*Damalis* HAM. SM., SUNDEV., *Boselaphus* HAM. SM.). Horns reclined in both sexes, marked by a spiral keel in males. Lachrymal sinuses none. Tail moderate, tufted at the tip.

Sp. *Antilope oreas* PALL., VOSMAER *Beschrijving van het Afrikaansche dier, bekend onder de benaaming van Eland*, Amsterd. 1783; BUFF. *Suppl.* VI. Pl. 12, SMITH *Illustr., Mamm.* Pl. 40, 41. This largest species of *Antelope* (it attains a length of 9 and a height of 5 feet) lives in herds of 10 or more together on the mountainous northern boundaries of the Cape Colony. The male has a dewlap deeply hanging down; colour yellowish-grey.

Oryx BLAINV., HAM. SM. Horns in both sexes very long, reclined, towards the tip smooth, acuminate. Lachrymal sinuses none. Tail moderate or long, at the tip setose. (Legs strong; trunk elongate; *habitus* of *Asinus*.)

Sp. *Antilope addax* LICHTENST. l. l. Tab. II. RUEPPELL *Atl. zu der Reise im nördl. Afr., Zool.* Tab. 7; milk-white, head and upper part of the neck reddish grey; a bunch of dark brown hair on the forehead, the horns bent three times sinuously with numerous rings;—*Antilope leucoryx* PALL., (and *Antil. gazella* PALL.) LICHTENST. l. l. Tab. I. GUÉR. *Iconogr., Mammif.* Pl. 44, fig. 3; white with neck reddish; the horns, which are gently curved,

terminate in a point and sometimes reach as far as the croup of the animal. The white tail has long, black hairs at its extremity.—*Antilope oryx* PALL. (*Capra Gazella* L., partly excl. of synon.), BUFF. *Suppl.* VI. Pl. 17, copied in SCHREB. *Säugth.* Tab. 257; this South-African species has very long and *straight* horns, pointed at the tip, which may be compared with the long tusk of the narwhal; colour light grey with brown legs; the knee of the fore legs is white; the long black hair of the tail sometimes hangs down nearly to the hoofs.

Catoblepas GRAY, HAM. SM., *Boselaphus* BLAINV. Horns in both sexes, broad at the base, at first diverging and slightly descending, then recurved, ascending. Muzzle broad, naked between the nostrils. Tail long, setose. Neck maned.

Sp. *Antilope Gnu* ZIMMERM., BUFF. *Suppl.* VI. Pl. 8, 9, VOSMAER *Beschr. van den boschbuffel*, Amsterd. 1784; *het wilde beest* of the colonists of the Cape;—*Antilope taurina*, *Catoblepas taurina* and *Gorgon* HAM. SM., SMITH *Illustr.* l. l. Pl. 38, CUV. *R. Ani., éd. ill., Mamm.* Pl. 92, fig. 2; the *blaauwe wilde beest*. Both are very remarkable animals of South Africa, which in some parts of the body present the form of a horse, in others that of the antelope, with the head and horns of a buffalo. They live in the high, grassy mountain-plains to the north of the Colony at the Cape, and perform annually a journey towards the South, when the last-named species does not pass further than the Orange river, whilst the *Gnu* penetrates into the territory of the colony.

Rupicapra BLAINV., *Capella* KEYSERL. and BLAS. Horns in both sexes near the middle of the forehead, round, small, erect, with the tip hooked backwards. Lachrymal sinuses none. Two glandular foramina behind the horns. False hoofs. Mammæ four.

Sp. *Rupicapra cemas* nob., *Capra Rupicapra* L., *Antilope rupicapra* PALL., BUFF. XII. Pl. 16, SCHREB. *Säugth.* Tab. 279; the *chamois, die Gemse;* of the size of a goat, lives on the Alps of Switzerland and the Tyrol. A local (smaller) variety, or, according to some, a different species (*Antilope pyrenaica*) lives on the Pyrenees.

Oreotragus SUNDEV. Horns in males only, short, subulate, acute, erect, distant at the base. Head small. Lachrymal sinuses small. Hoofs high, compressed; spurious hoofs subrotund, approximate. Tail very short.

Sp. *Oreotragus saltator, Antilope saltatrix* BODD., *Antilope oreotragus* FORST., GM., BUFF. *Suppl.* VI. Pl. 22, SCHREB. *Säugth.* Tab. 259; the *Klipspringer* of the Cape colonists; on the mountains of South Africa; in Abyssinia is found a smaller variety of a lighter colour.

Hemitragus nob., *Nemorhedus* HAM. SM. Horns in both sexes, annulate at the base, smooth towards the point, directed backwards.

Lachrymal sinuses small or none. A large black naked region produced from the septum of the nose (*Rhinarium*). Tail short. Mammæ four. (Habit hircine.)

Sp. *Hemitragus sumatrensis, Antilope sumatrensis* SHAW, F. CUV. *Mammif.* Pl. 27, *Antilope goral* HARDW.; Nepaul, &c.

Note.—Hemitragus HODG. to be inserted here, is scarcely a distinct genus. Nostrils distant. Horns approximate, deflected, sub-incurved, thick at the base, undulately ringed, smooth at the tip.—Sp. *Hemitragus iharal, Capra iharal* HODGSON *Asiat. Researches*, XVIII. 2, p. 129 (cited by WAGNER), SCHREB. *Säugth.* Tab. 281 D;—*Hemitragus hylocrius, Kemas hylocrius* OGILBY, *Proceed. Zool. Soc.* 1837, p. 81.

Capra L. (in part). Horns in both sexes, flat on the inside, curved, annulate, often knotted. Lachrymal sinuses none. Hoofs compressed, spurious hoofs small, rounded. Tail very short. Mammæ two. Throat bearded mostly in both sexes, sometimes in males only. (Region between the eyes and nostrils flat or concave.)

Sp. *Capra Ibex* L., BUFF. XII. Tab. 13 (Tab. 14 *Horns*), SCHREB. *Säugth.* Tab. 281 C; *der Steinbock, le Bouquetin;* with large, prominently knotted horns, colour greyish-red, no beard, but only somewhat longer hair under the chin; on the Swiss Alps;—*Capra siberica* EHRENB., *Ægoceros ibex* PALL., *Spic. Zool.* XI. Tab. 3;—*Capra beden* FORSK., *Capra sinaitica* EHRENB., *Symb. physicæ*, Tab. 18, CUV. *R. Ani., éd. ill., Mammif.* Pl. 93, fig. 1, SCHREB. 281 CC, &c. Upper Egypt, &c.

The goats live in troops on the mountains. Their senses are very acute. The domestic goat, *Capra Hircus* L., has a sharp edge at the inside of the horns, which is irregularly incised and sometimes very broad. Of this species there are many varieties. To this goat is similar *Capra Ægagrus* GMEL., the *Paseng* of the Caucasian mountains and Persia, *Ménag. du Mus.* II. pp. 177—193, GUÉRIN *Iconogr., Mammif.* Pl. 44 *bis*, fig. 2, *Dict. univ. d'Hist. nat., Mammif.* Pl. 13 (PALL. *Spic. Zool.* XI. pp. 43—46, Tab. 5, figs. 2, 3, *horns*).

To the genus *Capra* and not to the *Antilopes*, as I think (with SUNDEVALL), ought to be referred *Capra montana* HARLAN, *Antilope lanigera* HAM. SMITH, *Linn. Trans.* XIII. 1, pp. 38—40, Tab. IV., *Capra americana* RICHARDSON, *Faun. bor. Am.* I. Tab. 22, SCHREB. *Säugth.* Tab. 287 D. This species has small horns, turned backwards and slightly curved, and a white fleece. It forms the genus *Haplocerus* of HAM. SMITH.

Ovis L. Horns in both sexes or in males only, striated wavily, transverse at the base, turned backward, with the tip mostly again bent forward. Hoofs compressed. Mammæ two. Chin beardless. Region between the eyes and nostrils convex.

a) *With lackrymal sinuses none.*

Sp. *Ovis tragelaphus* Cuv., Schreb. *Säugth.* Tab. 288 B; ruddy, the horns thick at the base, bent outwards with the point in some degree curved downwards; long hair at the neck and fore legs, in North Africa.

b) *With lachrymal sinuses distinct.*

Sp. *Ovis Aries* L., Schreb. *Säugth.* Tab. 289—294 C; the *sheep*, with the tail usually longer than in any of the wild species. This animal is one of the most useful which man has subjected to himself[1]. Since it was originally an inhabitant of mountains, it thrives better in high and dry regions. It is subject to many diseases, amongst which the so-named *foot-rot* may be mentioned; under which appellation, however, very different maladies have been confounded. Frequently there arises a lameness of the feet[2], that to which we allude, from the suppression of a secretion formed by the sebaceous glands of a sacculated inversion of the skin, which opens in front between and above the hoofs of the fore and hind feet, and the consequent swelling of the apparatus. This dermal sac is found in some other ruminants, but in the hind feet alone. See A. Bonn *Verhandel. der Eerste Klasse der Koninkl. Nederl. Instituut*, Amsterdam, 1820, v. bl. 125—155, F. Klein *Diss. inaug. de sinu cutaneo ungularum Ovis et Capreæ*, cum tab. Berolini, 1830, 8vo; E. Rousseau, Guér. *Revue et Magasin de Zoologie*, 1852, pp. 510—516, Pl. 21.

Sheep begin to change their teeth in their first year; when three years old they have got all their permanent teeth, except the two outer incisors, which appear in the fourth year. The ram is fit for procreation when eighteen months old; the ewe can copulate when one year old; the period of gestation is about five months, the produce one or two lambs. The rams are mostly horned; sometimes the ewe also has horns, which however are smaller and less twisted. There are many varieties of the sheep, amongst which the merino-sheep (*varietas hispanica*) deserves mention on account of its fine wool, the *Astracan* sheep for the curly fleece of the lambs, and the *Iceland* sheep (*varietas polycerata*) for its four or six horns. In some the tail is peculiarly broad and fat; others are distinguished by large deposits of fat on the croup (*var. steotopyga* Pall.).

In the wild species the tail is very short. To these belongs *Ovis Ammon* (L., in part) Cuv., *Ovis argali* Pall. *Spic. Zool.* xi. Tab. 1; the Argali sheep. Of this species both sexes have horns, which in the female are smaller and at their base are set longitudinally on the skull (not with the broader surface transverse, as is usual in the sheep), in the male particularly thick and large. That our domestic sheep is derived from this species is scarcely probable; compare Tilesius, who defends this derivation, and Bojanus, who advances objections to it from difference in the skull, in *Act. Acad. Leop. Carol.* xii. 1, p. 279, pp. 291—300. Other writers

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[1] Although "*Pecus*" is applied by the ancients to denote all kinds of cattle, it refers especially, when no other name is added, to sheep. See Plinius Lib. viii. cap. 47.

[2] "*Turpis podagra*," Virgil. *Georg.* iii. 299.

suppose, without satisfactory grounds, that *Ovis muscimon* PALL. (BUFF. XI. Pl. 29, SCHREB. *Säugth.* Tab. 288 A, BRANDT u. RATZEB. *Mediz. Zool.* I. Tab. IX. fig. 1, CUV. *R. Ani., éd. ill., Mammif.* Pl. 93, fig. 2), a species from Sardinia and Corsica, which also occurs in Cyprus and in Persia, and which is much smaller, is to be regarded as our originally wild sheep.

Anoa HAM. SMITH, WAGN. Horns remote at the base, thick, flat upwards, striated transversely, subulate at the point, smooth, directed backwards, ascending but little. Rhinarium continued as far as the margin of upper lip. Ears short (scarcely equalling the third part of the length of head). Lachrymal sinuses none. Tail moderate, setose. Neck short. Legs low. Mammæ four.

Sp. *Anoa depressicornis, Antilope depressicornis* HAM. SM., QUOY *et* GAIMARD *Ann. des Sc. nat.* XVII. Pl. 20, pp. 423—426; Celebes; an intermediate form, between the antelopes and oxen; brown or blackish; the thighs on the inside and the fore legs at the lower part whitish.

Bos L. Horns round either throughout or towards the tip, turned outwards, incurved at the tip, ascending, with osseous nucleus cavernous. Lachrymal sinuses none. Rhinarium almost always below the nostrils large, broad. Tail moderate, tufted at the point or with long hair throughout. Mammæ four.

The genus of the *oxen* has a very wide geographical distribution, like the family of the grasses on which they feed; in South America, however, no originally wild species are met with.

Sp. *Bos Taurus* L., BUFF. IV. Pl. 14, SCHREB. *Säugth.* Tab. 297; common cattle are included under this name. The forehead is flat and the horns are set upon the edge which separates this flat forehead from the part of the head which descends downwards. Oxen may attain an age of 20 or 25 years, but rarely live so long, since they are mostly slaughtered at an earlier period. Period of gestation of the cow is about 280 days. The calf is born with four incisors and with three molars in each jaw on both sides; after the first year the change of the teeth begins, and after the third all the milk-teeth are replaced by permanent teeth.

Every one is acquainted with the manifold usefulness of this animal, of which the breed forms one of the chief sources of our national riches. Compare on the ox WAGNER in SCHREBER'S *Säugth.* V. S. 1566—1680, H. W. VON PABST *Anleitung zur Rindviehzucht, Mit 24 Bildern in lithogr. Farbendruck*, Stuttgart und Tübingen, 1851, 8vo, and (with special reference to the cattle of Holland) J. LE FRANCQ VAN BERKHEY *Natuurlijke Historie van het rundvee in Holland*, met platen, Leiden, 1805—1811, 8vo, VI. Deelen.

There are fewer varieties in cattle than in sheep. To the varieties belongs *Bos indicus* L., the *zebu*, distinguished by a hump on the back which, like that of the camel, consists of fat; sometimes this race is

destitute of horns (see *Ménag. du Mus.* I. pp. 235—255, II. pp. 218—223, CUV. *R. Ani., éd. ill., Mammif.* Pl. 94, fig. 1, V. PABST, Pl. 2, s. 21). This variety is met with in Arabia, Persia, the continent of India and some parts of Africa. The cattle of the Dutch East-Indian colonists are for the most part of this race, partly from crosses of this with the Sunda ox, *Bos sondaicus* S. MUELLER *Verh. over de nat. Geschiedenis der Nederl. Overzeesche Bezittingen, Mamm.* Pl. 35—39; with the Javanese *Bantang.*— On the continent of India (and, in former times at least, also in Ceylon) is a different species, *Bos frontalis* LAMBERT, *Bos gavœus, Bos gaurus,* SMITH.

To the same division of this genus belongs also a species occurring in diluvial deposits, from which, according to the opinion of CUVIER, our ox has descended. See *Ann. du Mus.* XII. p. 333 *et suiv.* This, however, is not beyond doubt; but that those remains belong to a species (*Bos primigenius* BOJAN.), which lived contemporaneously with man, has been asserted by NILSON, and there is all probability that this was not different from *Bos urus,* which was formerly dispersed through the forests of Germany and which was recorded by CÆSAR.

In the Bisons the horns are situated in front of the sharp line which divides the forehead from the descending part of the skull; the forehead is convex and broad, there are fourteen pairs of ribs, whilst *Bos taurus* has only thirteen.—*Bos bison* L., NILSON, *Bos urus* BOJAN. Compare BOJANUS *De uro nostrate ejusque sceleto commentatio,* 1825, in *Nov. Act. Acad. Cæs. Leop. Carol.* XIII. 2, pp. 414—478, Tab. 20, EICHWALD *Naturhistorische Skizze von Lithauen, Volhynien und Podolien,* Wilna, 1830, 4to, pp. 241—253 (with figure opposite the title-page). This animal, formerly dispersed throughout Germany, nay even in the South of Sweden, now lives only in the marshy forest Bialowesha in Lithuania, and in the Caucasus. (EICHWALD *Fauna Caspio-Caucasia,* 1841, pp. 40, 41). That *Bos americanus* GMEL., (CUV. *R. Ani., éd. ill., Mammif.* Pl. 94, fig. 2) differs from it only slightly, is generally admitted, and whether there be sufficient ground for the adoption of a specific difference is doubted by some; G. JÆGER *Würtemb. naturwissenschaftliche Jahreshefte,* III. 1847, p. 176, X. 1854, pp. 204—209.

Bos bubalis L., BUFF. XI. Pl. 25, SCHREB. *Säugth.* Taf. 300 A, GUÉRIN *Iconogr., Mammif.* Pl. 45, fig. 3, BRANDT *u.* RATZEB. *Mediz. Zool.* I. Tab. X. the *buffalo;* the horns are directed outwards and with a longitudinal projecting line. This species is originally from India, and was brought into Italy in the seventh century. The buffalo is peculiarly adapted for draught; its skin is highly valued, but its flesh is much inferior to that of the ox. In India there lives a variety of this species with very large horns, known by the name of *Bos arni;* see the head figured in BLUMENBACH *Abbildungen naturhist. Gegenst.* No. 63. At Java and others of the Sunda Islands the buffalo does not occur wild, but has returned to the wild state, and was perhaps introduced there with the cultivation of rice. It is the *Karbau* of the Malays; see S. MUELLER *Verhandel.* &c. op. cit. Pl. 40.

Bos caffer SPARRM., GM., SCHREB. *Säugth.* Tab. 301; the horns, placed close together at the base, are very broad, rough and sinuously ringed; the tip curved upwards and inwards is smooth; this species lives to the east of the Cape colony and in Mosambique.

Bos grunniens L., *Bos poëphagus* PALL., the *Yack*, a species from Thibet, which occurs in the wild and the tame state, with long hair and a long-haired tail, like that of a horse.

Of all the species, that which deviates most from our cattle is a species from the most northerly parts of North America, *Bos moschatus* ZIMMERM., GMEL., SCHREB. *Säugth.* Tab. 302 A (after PENNANT *Arctic Zool.*), 302 B. Compare HERMANN *Zur Geschichte des Bisamochses, Naturforscher* XIX. 1783, s. 91, Tab. V. This has a hairy muzzle (no rhinarium), and short tail concealed under the long hair; the horns approach each other at the base, and then proceed outwards and downwards, the point turning up again, nearly as in the *gnu*. This species forms the genus *Ovibos* BLAINVILLE, DESMAR., and the transition to the genus *Ovis*.

ORDER VI. *Edentata.* (*Bruta* L., exclusive of the genera *Elephas* and *Trichechus*.)

Teeth in the fore part of both jaws none, sometimes both jaws entirely edentulous. Toes with claws large, curved, often compressed.

The *edentate* mammals sometimes are altogether destitute of teeth, as the name indicates, but sometimes, on the contrary, have numerous teeth, which is in contradiction with that name; in the fore part, however, of the mouth the teeth are always absent. *Dasypus sexcinctus* L., (and *Das. villosus*) alone has, at the back part of the intermaxillary bone, on each side a tooth, which must consequently be named an incisor, and opposite to these two upper teeth are situated four in the lower jaw[1]. The rest have no incisor teeth, and also no true canine teeth. All the teeth are simple, without roots, with an undivided hollow base; thus they never cease to grow as they are worn down above; they consist of *dentine* and cement, without enamel.

All the species of the edentate mammals live in the warmest countries of the earth; in Europe no one animal is found which belongs to this order.

Compare W. VON RAPP *Anatomische Untersuchungen über die Edentaten* (*Mit Steindrucktafeln*, Tübingen, 1843, 4to; 2te *vermehrte Auflage*, 1852.)

Family XX. *Effodientia* ILLIG. Head produced to form an elongate, narrow snout. Feet short, hind feet longer. Claws curved, fossorial. Teeth either none or all similar in form.

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[1] See F. CUVIER *Des dents des Mammif.* pp. 195, 196, Pl. 96.

The *burrowing* edentate mammals are distinguished by a pointed and elongated head. They feed upon insects, some exclusively, whilst others add other food to this and feed principally upon offal, as *Dasypus duodecimcinctus* and *Das. septemcinctus.* Some climb trees (*Myrmecophaga didactyla* and *Myrmec. tetradactyla* or *tamandua*), in which they are assisted by a prehensile tail. *Manis javanica* also climbs trees and hides in their hollows. Most, however, live on the ground, or some few under ground in holes which they have dug.

Manis L. Teeth none. Ears small, mostly indistinct or scarcely any. Tongue round, exsertile. Body and tail covered with horny imbricate scales. Tail long.

The *scaled animals* live in warm countries of Asia and Africa. Their skeleton has no clavicles. They can, when danger impends, roll themselves into a ball, and are then protected by their scales, as the hedgehog is by his spines. Compare on the species of this genus SUNDEVALL *Ofversigt af Slägtet Manis, Stockh. Vetensk. Akad. Handl.* 1842, pp. 245—282, and FOCILLON *Du genre Pangolin,* GUÉRIN *Revue et Magas. de Zool.* 1850, pp. 465—474, pp. 513—534, Pl. 10, 11.

Sp. *Manis longicaudata* SHAW, *Manis tetradactyla* L., *Manis macroura* ERXL. BUFF. X. Pl. 35 (SCHREB. *Säugth.* Tab. 70), GUÉR. *Iconogr., Mammif.* Pl. 35, fig. 4, from the coast of Guinea; the tail is nearly twice as long as the head and trunk; the scales are large, black with yellow margin, and are set upon the trunk in eleven rows.—Another species from the coast of Guinea has 19 or 21 rows of scales; these are small, yellow-grey, with three points behind; *Manis tricuspis* RAFINESQUE, *Manis multiscutata* GRAY.

In other species the tail has about the length of the trunk with the head, or is something shorter. Here belongs that which lives on the continent of India and at Ceylon, *Manis laticauda* ILLIG., *Manis pentadactyla* L. (in part), *Manis brachyura* ERXL., CUV. *R. Ani., éd. ill., Mammif.* Pl. 74, the largest known species of this genus; *Manis Temmincki* SMUTS, SUNDEV. l. l. Tab. IV. fig. 2, SMITH *Illustr. of the Zool. of S. Afr., Mamm.* Pl. 7; to the north of the Cape Colony, in Mozambique, also in Sennaar; —*Manis javanica* DESMAR., RAPP, l. l. Tab. II. fig. 2; Java, Borneo, &c.

Myrmecophaga L. Teeth none. Ears small, rounded and oval. Body covered with hair. Tail long.

The *ant-eaters* represent in the New World the scaled animals of Africa and Asia. They all live in South America, in the forests, and feed on ants and white ants, whose nests they tear up with their large nails, and on other insects, caterpillars, &c. Their extensile tongue is constantly covered with an adhesive mucus.

Sp. *a. With fore feet tetradactylous, hind feet pentadactylous. Myrmecophaga jubata* L., BUFF. X. Tab. 29 (fig. deformed), *Suppl.* III. Pl. 55 (scarcely better), BLUMENB. *Abbild. naturh. Gegenst.* No. 82, *Dict. univ. d'Hist. nat., Mammif.* Pl. 16, fig. 2; this is the largest species, and attains nearly four feet, besides the tail, which is more than 2½ feet long. The hair is long, especially on the back forwards and on the tail, and bristly; the colour is grey with black throat and a triangular black spot ascending from this obliquely over the shoulders; Brasil, Surinam.—*Myrmecophaga tetradactyla* L. (and *tridactyla* ejusd., a species to be suppressed), *Myrmecophaga tamandua* CUV., SCHREB. *Säugth.* Tab. 68 (fig. of MARCGRAFF), RAPP l. l. Tab. 11, fig. 1 (2d edit. Tab. 11, 6); smaller, the tail scaly at the extremity; variously coloured. (TEMMINCK distinguishes this Brasilian species as *Myrmecophaga bivittata* from the species from Surinam which he names *Myrmecophaga tamandua*, yellowish-grey, one-coloured, with longer tail and somewhat larger ears.)

β) With fore feet didactylous, hind feet tetradactylous. (*Snout shorter. Coat thick, woolly*). Sp. *Myrmecophaga didactyla* L., SCHREB. *Säugth.* Tab. 66, BLUMENBACH *Abbild.* No. 22, GUÉR. *Icon., Mammif.* Pl. 35, fig. 2; this small species lives in Guiana and Surinam; the ribs are very broad and flat, and their posterior margin overlaps the anterior margin of the succeeding rib. In this species the vessels of the fore limbs form plexuses; compare on their anatomical structure DAUBENTON, BUFF. X. pp. 165—175, J. F. MECKEL *Archiv f. d. Physiol.* V. 1819, s. 1—67.

Orycteropus GEOFFR. ST.-HIL. Incisors and canines none, molars various according to age $\frac{7-7}{6-6}$, in the aged $\frac{5-5}{5-5}$, cylindrical, composed of vertical tubes, with flat crown. Body hairy. Feet short, anterior tetradactylous, posterior pentadactylous, with claws strong, fossorial, ungular. Ears elongate, acuminate. Tail moderate, thick, hairy.

Sp. *Orycteropus capensis* GEOFFR., *Myrmecophaga afra* PALL., *Myrmecophaga capensis* GM., GUÉRIN *Iconogr., Mammif.* Pl. 35, fig. 1, PALLAS *Observationes circa Myrmecophagam africanam e litteris Cel*ⁱ. P. CAMPER. *excerptæ et illustratæ. Act. Acad. Scientiar. Petropolit., pro anno* 1777, p. 223, Tab. IX. B; comp. H. F. JÆGER *Anat. Untersuchungen des Orycteropus capensis*, Stuttgart, 1837, 4to (with a fig. copied in RAPP l. l. Tab. 1). This species, *het aardvarken* of South Africa, lives in subterraneous cavities and attains a length of 4 feet and more. In the skeleton itself there are only four toes on the fore feet, whilst that of *Myrmecophaga jubata* has five; the cervical vertebræ are particularly strong. (In Abyssinia also and in Senegal similar animals occur which have been regarded as different species. See SUNDEVALL *Vetensk. Akad. Handl.* 1842, pp. 236—242, DUVERNOY in GUÉR. *Revue et Magas. de Zool.* 1852, pp. 581, 582, and *Mém. sur l'Oryct. du Nil*, &c. *Ann. des Sc. nat.* 3ième Sér. XIX. pp. 181—202, Pl. 9, 10.) Compare on the structure of the teeth in *Orycteropus* F. CUVIER *Des dents des Mamm.* Pl. 82, and OWEN *Odontogr.* pp. 317—320, Pl. 77, 78.

Dasypus L. Teeth small, distant, cylindric, in various number, in both jaws. Body covered by very hard mail formed of regular scutes, mostly hexagonal, the back intersected by zones. Ears somewhat large. Hairs scattered between the scutes and the zones. Tail of various length, covered by scutella, tuberculate or naked. Feet either all pentadactylous or anterior tetradactylous.

The *Armadillos*. All these animals live in South America. The skeleton is distinguished by the peculiar breadth of the first rib, by well-developed clavicles, and by a second projecting line under the spine of the scapula (also more or less present in the ant-eaters), and also by an elongation of the *acromion* over the humerus. They bury themselves under ground when pursued. By some the flesh is considered well-tasted. According to AZARA the dorsal shield is used for making guitars by the Brasilians.

a) *With fore feet tetradactylous, hind feet pentadactylous.*

Sp. *Dasypus novemcinctus* L., *Das. longicaudus* MAX. NEUW., SCHREB. *Säugth.* Tab. 74, BLUMENB. *Abb. naturh. Gegenst.* No. 83; the tail ringed and at every ring regularly attenuated, of the length of the body; $\frac{7-7}{8-8}$ molars or thereabouts. This species is one of the commonest and is found in Brasil, Guiana and Surinam.—*Dasypus conurus* ISID. GEOFFR.[1], *Mataco* of AZARA; with short tail.

b) *With all the feet pentadactylous.*

Sp. *Dasypus tricinctus* L., SCHREB. *Säugth.* 71. This species has a short tail, the body very convex backwards, like a tortoise; it can roll itself up. (The genus *Tolypeutes* ILLIG.) *Dasypus sexcinctus* L. (and *octodecimcinctus* GM.), *Dasypus setosus* NEUW., SCHREB. *Säugth.* Tab. 71 B, GUÉRIN *Iconogr., Mammif.* Pl. 34, fig. 1, *Dict. univ. d'Hist. nat., Mammif.* Pl. 15, fig. 1; *Tatusia* F. CUV.

The largest species is *Dasypus gigas* CUV., BUFF. X. Pl. 45, KRAUSS *Thierreich in Bildern, Säugth.* Tab. 24, fig. 5 (the genus *Priodon* F. CUV.). The small molars are very numerous, 16, 18 or more on each side $\left(\frac{25-25}{25-25}\right.$ F. CUV.$\left.\right)$. This species is found in Surinam and Brasil, and attains a length of 3 feet. The Botucodos make speaking trumpets from the tail, which they use in the forests. NEUWIED *Reise nach Brasil.* I. S. 363, 364.

Chlamydophorus (*Chlamyphorus* HARLAN). Molar teeth $\frac{8-8}{8-8}$. Ears almost none, concealed under hair. Back covered with a coriaceous test, truncated posteriorly, composed of transverse rows of scutella; leg, abdomen, and sides hairy. Feet pentadactylous; claws of fore feet very long, acute. Tail rigid, bent under the body.

[1] *Dasypus tricinctus* auctor., in part; see ISIDORE GEOFFROY SAINT-HILAIRE, GUÉRIN *Revue Zool.* 1847.

Sp. *Chlamydophorus truncatus* HARL. *Ann. of the Lyc. of New York*, I. p. 235, Tab. 21, copied in the *Ann. des Sc. nat.* V. 1825, pp. 5—17, Pl. 1, GUÉR. *Iconogr., Mamm.* Pl. 34, fig. 3; an animal of the size of the common mole, found in Chili, and which mostly keeps under ground. See the skeleton described by YARRELL *Zool. Journ.* III. No. 12, 1828, p. 544, Tab. 16, 17, OKEN'S *Isis*, 1830, p. 926, Tab. IX. and especially a monograph by HYRTL *Chlamydophori truncati cum Dasypode gymnuro comparati Examen anatom.*, in *Denkschr. der Kais. Acad. d. Wissensch.* IX. Wien, 1855, s. 1—66, with figures.

Family XXI. *Tardigrada* ILLIG. Head truncated anteriorly, flat. Legs, especially the anterior, very long. Claws incurved, compressed.

The *sloths* live in South America, principally in the large forests; they feed on the leaves of trees; the females bear only a single young one, and carry it, as long as it continues to suck, on their back[1].

Compare CUVIER *sur l'Ostéologie des Paresseux, Ann. du Mus.* V. pp. 189—215, Pl. 14—17; A. BRANTS *Dissert. zool. inaug. de Tardigradis*, cum II. Tab. L. B. 1828, 4to.

Bradypus L. Body hairy. Molar teeth separate, cylindric. Ears very short, concealed under hair. Fore feet tridactylous or didactylous, hind feet tridactylous, with toes conjoined as far as the claws. Two pectoral mammæ. Tail very short, or none.

Bradypus ILLIG., *Acheus* F. CUV. Molars $\frac{5—5}{4—4}$ (or in younger individuals $\frac{5—5}{5—5}$) with the first small. Fore feet tridactylous, longer than hind feet. Tail very short.

Sp. *Bradypus cuculliger* WAGL., *Bradypus gularis* RUEPPELL *Mus. Senck.* III. s. 138, 139, Taf. XI., CUV. *R. Ani., éd. ill., Mamm.* Pl. 70; *Aï à dos brulé* DAUBENTON in BUFF. XIII. Pl. 32; Surinam, Guiana;—*Bradypus pallidus* WAGN., *Bradypus tridactylus* MAXIM. *Abb. zur Naturgesch. Brasil.* 2te Lief. (The name of *Brad. tridactylus* L. is merely given arbitrarily to one of these two species, since it rests upon the opinion that there is only one species with 3 toes on the fore feet.)—*Bradypus torquatus* ILLIG., MAXIM. *Abb. zur Naturgesch. Bras.* 6te Lief., GUÉR. *Iconogr., Mammif.* Pl. 23, fig. 1; both species from the North and East of Brasil; the last also, though rare, in Peru;—*Bradypus infuscatus* WAGL. North western

[1] Interesting particulars on the mode of life and properties of the sloths have been given by HUMBOLDT and TSCHUDI. See TSCHUDI *Fauna Peruana*, I. pp. 202—205.

part of Brasil, Peru. Compare on these four species and some others of which the distinction is not yet suffiociently established, WAGNER in *Archiv für Naturgesch.* 1850, s. 367—387, and in SCHREB. *Säugth. Supplementband*, 5 *Abth.* 1853, s. 162—173.

Cholœpus ILLIG., *Bradypus* F. CUV. First molar tooth very long, acuminate, resembling a canine, with the inferior placed behind the upper; remaining molars $\frac{4—4}{3—3}$, with crown cuneate, worn obliquely in front and behind. Fore feet didactylous. Tail none.

Of this sub-genus one species only is known, which therefore provisionally may retain the name of *Bradypus didactylus* L. The head is more protracted and the fore legs are less elongate than in the three-toed species. A figure may be seen in SCHREBER'S *Säugth.* Tab. 65, copied from BUFFON XII. Pl. 1, and a better in GUÉR. *Iconogr., Mammif.* Pl. 33, fig. 2; the skeleton is figured in PANDER *u.* D'ALTON *Das Riesenfaulthier*, Bonn, 1821, Tab. VII.

Different fossil species belong to the order of the edentates; most of them are found in diluvial deposits and in caves. Some appear to belong to the genus *Dasypus*. Others form a transition between the two families of edentates, and present in the malar bone, which terminates in a process descending obliquely over the lower jaw, a resemblance to the genus *Bradypus*, whilst the bones of the limbs are massive and large. Here belongs the genus *Megalonyx* JEFFERSON, CUV. and *Megatherium* CUV. (comp. CUV. *Ann. du Mus.* V. pp. 358—400, Pl. 23—25, *Recherches sur les ossem. fossiles* VI. pp. 159—195). The genus *Megatherium* is best known of the two. *Megatherium Cuvierii* was an animal which must have been about 12 feet long and 5 feet high, and of which a skeleton was found not far from Buenos-Ayres at the end of the last century, which is now preserved at Madrid. This skeleton is beautifully figured by PANDER *und* D'ALTON *Das Riesenfaulthier*, Tab. I. II. Afterwards was discovered the genus *Mylodon* OWEN (*Description of the Skeleton of an extinct gigantic Sloth*, London, 1843, 4to, *Ann. des Sc. nat.* 2e Série, XIX. pp. 221—263), of which a skeleton found to the north of Buenos-Ayres is preserved in the collection of the *College of Surgeons* at London, the genus *Glyptodon* OWEN which more closely follows *Dasypus* and others. The investigations of LUND in Brasil in the last few years have contributed greatly to extend and multiply our knowledge of these fossil animals. Compare PICTET *Traité de Palœontologie*, 2 éd. I. pp. 263—278. See LEIDY *On the extinct Sloth tribe of North America; Smithsonian Contributions to Knowledge*, 1855, Vol. VII.

ORDER VII. *Glires* s. *Rodentia*.

Incisor teeth in both jaws two, large, incurved, destitute of roots. Canines none. Molars remote from incisors by an interval, mostly few, rarely more than four in each side of both jaws. Feet unguiculate, in most pentadactylous.

The *Rodents*. The incisors are covered by a plate of enamel on the anterior surface only, which in many species is coloured yellow or ruddy-brown (by a very thin layer of cement)[1]. Not only the enamel, but also the anterior dentine is harder than the posterior of the incisors; hence a greater wearing down of these teeth is effected at the back part by use, and their crowns acquire a chisel-shape with a surface declining from the sharp anterior margin backward. The condyle of the lower jaw is longitudinal, and slides forward and backward.

The rodents live principally, or exclusively, on vegetable food, often on hard parts of plants, as bark of trees, roots, &c. They are commonly small, and exceedingly prolific. The species are very numerous (compare p. 605); about one-fifth of these are found in North America, where especially many species of the genus *Arctomys*, *Sciurus* and *Lepus* occur.

Compare on this order PALLAS *Novæ species Quadrupedum e Glirium ordine*, Erlangæ, 1778, 4to; of the anatomical peculiarities RYMER JONES has given a compendious account in his article *Rodentia*, TODD'S *Cyclopædia*, IV. pp. 368—396.

Family XXII. *Duplicidentata*. Upper incisors four, duplicate, with two thin teeth placed behind the anteror and normal. Molars destitute of roots, formed of two coalesced laminæ, upper six or five on each side, lower six. Fore feet pentadactylous, hind feet tetradactylous with hairy soles. Claws elongate, compressed. Teats several (4—10). Tail short or none.

Lepus L. Ears elongate. Tail recurved, short. Hind legs much longer than fore legs. (Molar teeth $\frac{6-6}{5-5}$. Dental formula OWEN, i. $\frac{2-2}{1-1}$, p. $\frac{3-3}{2-2}$, m. $\frac{3-3}{3-3} = 28$, the last upper molar small, simple. Clavicles imperfect.)

The hares are distinguished from all the other rodents by the two small upper incisors placed behind the usual ones. When the mouth is closed the inferior molars are situated within the margin of the superior molars, as in the *ruminantia*. Hence for the due production of chewing a large lateral motion is required, which is therefore facilitated by the free articulation of the hemispherical articular condyle of the lower jaw and the shallow articular cavity. By this motion the surface of the molars is unequally worn down, and presents projecting lines of enamel with intervening

[1] OWEN'S *Odontography*, p. 399.

depressions of dentine. (BENNETT *Zool. Soc.* I. 1833, p. 60).—The two orbits are perforated by a single and common *foramen opticum*. The bony palate is very imperfect, and forms merely a transverse strip between the anterior molars. (These peculiarities also apply to the following genus *Lagomys*.)

Sp. *Lepus timidus* L., SCHREB. *Säugth.* Tab. 233 A; GUÉRIN *Iconogr., Mammif.* Pl. 31, fig. 1; *the hare, le lièvre, der Hase;* dispersed nearly throughout the whole of Europe; is not met with in Sweden and Norway; the ears are longer than the head; the tail white, black above;—*Lepus variabilis* PALL., SCHREB. *Säugth.* Tab. 235 A, B; *the mountain-hare,* ears nearly of the length of the head; tail grey above; in the summer brown; in winter white, except the borders of the ears, which remain black; in Sweden, the Swiss Alps[1], Scotland and Ireland;—*Lepus cuniculus* L., SCHREB. *Säugth.* Tab. 236 A; *the rabbit, le lapin, das Kaninchen.* The wild rabbits are grey with a ruddy spot on the neck; the ears are somewhat shorter than the head. *Lepus brachyurus* TEMM. from Japan, and *Lepus hispidus* PEARSON, from Assam, are distinguished by the ears shorter than the head and the tail very short; of this last species BLYTH has formed the sub-genus *Caprologus*[2]. *Ann. and Mag. of nat. Hist.* XVII. 1846, p. 163. On the other species see WATERHOUSE *Mamm.* II. pp. 33—147.

Lagomys CUV. Ears short, rounded. Tail none. (Molar teeth $\frac{5-5}{5-5}$. Clavicles perfect.)

To this genus belong some small species, mostly from the North-West of Asia. The skull is more elongate and less high in front. Sp. *Lagomys alpinus, Lepus alpinus* PALL. *Nov. Spec. Glir.* Tab. II., SCHREB. *Säugth.* Tab. 238;—*Lagomys Ogotona, Lepus Ogotona* PALL. ib. Tab. III.; the *Ogotona* of the Mongols, to the South of the lake Baikal, &c.—*Lagomys princeps* RICHARDS. *Faun. bor. Amer.* Pl. 19, in North America, *Rocky Mountains.*

Many fossil remains belonging to this genus are found in the fissures of the limestone rocks on the coast of the Mediterranean Sea, especially in Corsica and Sardinia.

Family XXIII. *Subungulata* ILLIG. Molar teeth $\frac{4-4}{4-4}$, complex or lamellose. Fore feet tetradactylous or pentadactylous, hind feet mostly tridactylous, or pentadactylous, with lateral digits small, remote. Claws large, ungular, or compressed, keeled above.

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[1] "*In alpibus candidi.....; rutilescunt annis omnibus.*" PLINIUS Lib. VIII. c. 55.

[2] WATERHOUSE writes *Carpologus,* but the name appears to be derived from the stiff *bristles* (κάπρος, a hog).

Body hairy. Tail short or none. Ears rounded or oval, moderate.

These rodents, which have much affinity with *Hystrix*, were by LINNÆUS referred to the genus *Mus*, by KLEIN, PALLAS, GMELIN united in a distinct genus, *Cavia*. They all live in South America.

Cavia CUV., ILLIG. (Spec. of the genus *Cavia* PALL., GM.). Incisors smooth anteriorly, white or pale-yellow; molars destitute of roots, lamellose, in rows converging anteriorly, formed of two triangular parts with cement filling the fissure between them. Feet cloven, anterior tetradactylous, posterior tridactylous. (Dental formula OWEN, i. $\frac{1-1}{1-1}$, p. $\frac{1-1}{1-1}$, m. $\frac{3-3}{3-3} = 20$.)

Dolichotis WAGN. Ears broad at the base, somewhat large, more than half the length of head. Feet high. Tail very short.

Sp. *Cavia patagonica* PENN., SHAW, *Mara magellanica* LESSON *Centurie Zool.* Pl. 42, WATERH. *Mamm.* II. Pl. 3, fig. 1, *Lièvre pampa* D'AZARA; this species has some resemblance to a hare, but differs (especially in the high legs) from the other species of this genus, which it surpasses in size, more in external aspect than in essential characters.

Cavia (in the stricter sense). Ears rounded, much shorter than half the head. Feet short. Tail none.

Sp. *Cavia rupestris* MAXIM. *Abb. zur Naturgesch. Brasil.* Lief. IV. Tab. 3; *Moco* of the Brasilians. The sub-genus *Kerodon* of F. CUV. *Dents des Mammif.* Pl. 48; greyish, below pale-coloured; the hind legs ruddy; lives in the higher rocky regions of Brasil;—*Cavia aperea* ERXL., MAXIM. l. l., GUÉR. *Iconogr., Mammif.* Pl. 32, fig. 1, SCHREB. *Säugth.* Tab. 173 A, fig. 3; with hair brown, at the point reddish-yellow; throat pale; lives in grassy districts, at the edges of woods, throughout the greater part of South America. It has been supposed that *Cavia cobaya* SCHREB., DESM., *Mus porcellus* L. (the *guinea-pig, le Cochon d'Inde, das Meerschweinchen*), BUFF. VIII. Pl. 1, SCHREB. *Säugth.* Tab. 173, is derived from this species. This little animal, black with white and orange-coloured spots, procreates very readily in Europe, and has often been submitted to physiological experiments. See, respecting it, J. J. NAUMAN in LINN. *Amœn. Acad.* IV. pp. 190—209; J. J. FREULER *Monographia Caviæ Porcelli zoologica*, Gottingæ, 1820, 4to.

Hydrochœrus BRISS. (not BODD.), ILLIG., CUV. Upper incisor teeth indented anteriorly by a superficial longitudinal groove. Molar teeth destitute of roots, lamellose, the posterior tooth of both jaws large, composed of many lamellæ. Head thick, protracted in front

of eyes, with lip entire. Feet semi-palmate, the anterior tetradactylous, the posterior tridactylous. Claws broad, ungular. Body covered with hair thinly disposed, setaceous, long. Tail none.

Sp. *Hydrochœrus capybara* DESM., *Sus Hydrochœris* L., BUFF. XII. Pl. 49, GUÉRIN *Iconogr., Mammif.* Pl. 31, fig. 3. This animal is the largest of the order, and attains a length of 3 to 4 feet. The *capybara* lives on the banks of rivers in Brasil, Surinam and throughout nearly the whole of South America.

Cœlogenys F. CUV., ILLIG. Molar teeth complex or semi-complex. Lip cloven. Fore feet with four toes and unguiculate hallucar wart; hind feet tridactylous. Tail very short. (A fold of skin under the zygoma large and tumid. Internal buccal pouches.)

Comp. F. CUVIER *Du genre Paca, Cœlogenys, Ann. du Mus.* X. 1807, pp. 203—209, Pl. IX. A, figs. 1—6.

Sp. *Cœlogenys subnigra* and *Cœl. fulva*, probably only varieties of the same species, *Mus Paca* L. (*Cavia Paca* auctor.) BUFF. X. Pl. 43, *Suppl.* III. Pl. 33, GUÉR. *Iconogr., Mammif.* Pl. 32, fig. 3. This animal attains a length of nearly two feet; colour dark brown or reddish with white spots, placed on the sides of the body in four or five longitudinal rows. The flesh, which is very fat, is eaten. The buccal pouches were first described by GEOFFROY ST.-HILAIRE *Ann. du Mus.* IV. 1804, pp. 99—101.

Dasyprocta ILLIG., *Chloromys* F. CUV. Molar teeth complex. Lip cloven. Fore feet with four toes and hallucar wart; hinder tridactylous. Tail a short, naked tubercle. Hair towards the hind part of back and over the hips elongate.

Sp. *Dasyprocta Aguti* DESM., *Mus Aguti* L., BUFF. VIII. Pl. 50, CUV. *Ménag. du Mus.* I. pp. 271—284;—*Dasypr. Acuschy* DESM., *Cavia Acuschy* BUFF. *Suppl.* III. Pl. 36, GUÉR. *Iconogr., Mammif.* Pl. 32, fig. 2 (with tail longer than in the preceding). Both species from the North of Brasil, from Guiana and Surinam; commonly pursued as game in Brasil; whilst feeding they sit on the hind feet, holding the food with their fore feet.

Family XXIV. *Aculeata.* Molars in adults $\frac{4-4}{4-4}$, complex, with undulate striæ of enamel in the crown. Incisors large, mostly coloured anteriorly, not grooved. Body covered with rigid, acuminate spines. Fore feet tetradactylous, with pollex very small, resembling a wart, hind feet pentadactylous or tetradactylous.

This family consists of the *porcupines*, the genus *Hystrix* L. Species belonging to it are found both in the Old and the New

World, but all, with the exception of a single species, in warm countries. These animals possess clavicles, which, however, are not quite perfect, being attached to the sternum only and not to the scapula; they have commonly fourteen ribs; the length of the tail and the number of its component vertebræ is very various. The skeleton presents, in all instances, five digits on the fore and hind limbs, of which however the innermost is short or imperfect. They feed on young shoots of trees, bark and fruits.

Comp. F. Cuvier *Examen des espèces du genre Porc-épic*, &c., *Mém. du Mus.* ix. 1822, pp. 413—437, with fig.;—J. F. Brandt *Mammalium exoticorum novorum vel minus recte cognitorum Descriptiones et Icones*, Petropoli, 1835, pp. 21—89.

Tribe I. *Philodendræ* Brandt. Head short, truncate anteriorly. Molar teeth with roots distinctly divided, somewhat short, sinking into the jaws not very deeply. Orbital process situated over the first molar tooth. Soles of feet warty. (Species American.)

Cercolabes Brandt (*Sphiggurus* and *Synctheres* F. Cuv.). Tail long, prehensile, thinly haired towards the tip, annulate. Hind feet with only four unguiculate toes.

Sp. *Cercolabes prehensilis*, *Hystrix prehensilis* L., Buff. *Suppl.* vii. Pl. 78, Cuv. *R. Ani., éd. ill., Mammif.* Pl. 65, fig. 1; Brasil, Surinam, with strong spines, black at the base, white at the point;—*Cercolabes insidiosus* Brandt, *Hystrix insidiosa* Lichtenst., *Sphiggurus villosus* F. Cuv., Max. *Abb. zur Naturgesch.* Lief. ii., Schreb. *Säugth.* Tab. 168 A, Guér. *Iconogr., Mammif.* Pl. 30, fig. 2; smaller; the spines concealed under the long hair of the back. These species live in trees in South America, feed on fruits, and are very slow in their movements; they mostly rest by day. (See also Burmeister *Syst. Uebersicht der Thiere Brasiliens*, i. Berlin, 1854, s. 216—225.)

Note.—Sub-genus *Chætomys* Gray [1], *Plectrochærus* Pictet (is it a distinct genus?). Spines flexile on the head and fore part of the back, passing into setæ on the rest of the back. Skull differs from that of the rest of the *Aculeata* by the orbit nearly closed posteriorly and the broad zygoma. Sp. *Cercol. subspinosus* Wagn., *Hystrix subspinosa* Lichtenst., Kuhl. Hab. in the North of Brasil.

Erethizon F. Cuv. Tail short. Hind feet with five unguiculate toes. Spines concealed amongst the long hair.

Sp. *Erethizon dorsatum* Cuv., *Hystrix dorsata* L., Buff. xii. Pl. 55, Richards. *Faun. bor. Am.* i. pp. 214—216; in North America from 37° to 67° N.L.; the individuals of this species are very variously coloured; some yellow-brown, others black.

[1] *Proceed. of the Zool. Soc.* 1843, pp. 21, 22.

Tribe II. *Philogœæ.* Molars with root formed at a late period only, long undivided, received in somewhat deep sockets. Orbital process (anterior margin of orbit) placed over third molar tooth. Soles of feet grooved, in other respects smooth. (Species from the Eastern hemisphere.)

Hystrix L. (in part), *Hystrix* (and *Acanthion*) F. Cuv. (add genus *Atherura* F. Cuv.). Hind feet with five unguiculate toes. Tail not prehensile.

Sp. *Hystrix cristata* L., Buff. xii. Pl. 51, 52, Schreb. *Säugth.* Tab. 167, fig. 1, Guér. *Iconogr., Mammif.* Pl. 30, fig. 1; the *porcupine, le porc-épic, das Stachelschwein;* long bristly hair on the back of the head and neck; the spines on the back long, with black and white rings; tail short, provided as in some other species with hollow, horny tubes fastened on thin stems, which at first are closed at the end, but afterwards become open by use, and when moved make a rattling sound. This species is found in Italy, Spain and the North of Africa. A very similar species occurs in South-Africa, but presents some difference in the cranium, *Hystrix Africæ Australis* Peters *Reise nach Mossambique,* i. *Säugth.* s. 170, Tab. 32, figs. 6, 7. A third allied species occurs on the continent of India, *Hystrix hirsutirostris* Brandt, *Hystrix leucurus* Sykes.—*Hystrix javanica, Acanthion javanicum* F. Cuv., with awl-shaped, brown spines yellow at the base and tip, &c.

In other species the tail is long, covered with rings of scales, and furnished at the extremity with a bunch of flat, sinuous and tortuous bristles: *Hystrix mœroura* L., *Hystrix fasciculata* Shaw (Waterhouse distinguishes three species here.)

Family XXV. *Palmipedia* s. *Castorina.* Incisors smooth in front, coloured. Molars $\frac{4-4}{4-4}$ complex, with four folds of enamel, the upper with three external, one internal; the lower with one external, three internal. Feet pentadactylous, hinder palmate. Ears small, rounded. (Clavicles distinct.)

Castor L. All the toes of hind feet connected by membrane. Second toe with two oblique claws. Tail depressed, oval, scaly. Dent. form. Owen, i. $\frac{1-1}{1-1}$, p. $\frac{1-1}{1-1}$, m. $\frac{3-3}{3-3} = 20$.

Sp. *Castor Fiber* L., Buff. Tome viii. Pl. 36, Schreb. *Säugth.* Tab. 175, *Dict. univ. d'Hist. nat., Mammif.* Pl. 9 A bis, fig. 1; the skeleton figured in Pander and D'Alton *Vergl. Osteol.* v. Tab. ii.; the *beaver, le castor, der Biber;* attains a length of 2½ to 3 feet, without the tail; reddish or yellow-brown. These beavers, now repelled within narrower limits, live

solitary in Europe and the North of Asia, and in society now only in some districts of North America. These social beavers fell large trunks of trees by means of their sharp teeth for constructing domed habitations in water, which they surround with a mound of trunks of trees, branches, earth, &c.[1] These animals are hunted for their fur and for the *castoreum*. This last is found in both sexes in two sacs, which in the male open into a canal formed in and by the prepuce, in the female into the vagina. Below these two sacs lie a pair of smaller sacs, of a more elongate form, which contain an unctuous matter. Compare A. C. BONN *Anatome Castoris*, L. B. 1806, 4to, *c. tab.* and especially BRANDT *u.* RATZEBURG *Medizin. Zoologie*, I. s. 12—30, Tab. III. IV. where a succinct account may be found of all that is known of the economy and the anatomy of the beaver from works of the best authors. BRANDT has recently distinguished the American beaver (*Castor americanus*) from *Castor fiber* chiefly by osteological characters of the skull. See his *Beiträge zur näheren Kenntniss der Gattung Castor*, *Mém. de l'Acad. de St.-Petersbourg*, VII. 1855, pp. 43—76.

Myopotamus COMMERSON. Fifth toe of hind feet situated beyond the membrane conjoining the rest of the toes. Tail round, elongate, pilose. (Four teats on each side, nearer the back than the belly, covered by hair. Dental formula as in *Castor*.)

Sp. *Myopotamus coypus* CUV., *Myopotamus bonariensis* COMM., GEOFFR. SAINT-HILAIRE *Ann. du Mus.* VI. Pl. 35, pp. 81, 86—88; GUÉR. *Iconogr., Mammif.* Pl. 29, fig. 3; three feet long, of which the tail forms nearly one-third; lives in Chili in holes on the banks of rivers. Compare LEREBOULLET *Notes pour servir à l'Anatomie du Coipou*, avec 2 pl.; *Mém. de la Soc. d'Hist. nat. de Strasbourg*, Tome III. 1846. The skins, which are used for making hats, bear in the trade the name of *American Otter*, and are annually brought to Europe by hundreds of thousands.

Family XXVI. *Murina*. Inferior incisors compressed, acuminate. Molars uniformly covered by enamel, mostly $\frac{3-3}{3-3}$. Fore feet almost always furnished with four wide-spread toes, and a wart for a thumb often unguiculate; hind feet pentadactylous. Tail most frequently long, thinly haired. Clavicles distinct.

Compare on this family and on other genera formed from the genus *Mus* L., A. BRANTS *het geslacht der muizen*, Berljn, 1827, 8vo.

Hydromys GEOFFR. (excl. of *Hydr. coypus*). Incisors smooth in front; molars $\frac{2-2}{2-2}$, uniformly enamelled, crown with transverse

[1] A beaver even in solitude built in the *Jardin des Plantes* at Paris a wall of bark, &c. to protect itself from the cold; GEOFFR. SAINT-HILAIRE *Mém. du Mus.* XII. p. 232.

tubercles, little distinct; anterior molar larger. Feet pentadactylous, posterior semi-palmate. Tail thick at the base, thinly haired, round. Dental formula OWEN, c. $\frac{1-1}{1-1}$, p. $\frac{1-1}{1-1}$, m. $\frac{1-1}{1-1}=12$.

Sp. *Hydromys chrysogaster* GEOFFR., GUÉR. *Iconogr., Mammif.* Pl. 25, fig. 1;—*Hydromys leucogaster* GEOFFR. On this genus from New Holland and Van Diemen's Land, compare GEOFFROY SAINT-HIL., *Ann. du Mus.* VI. pp. 88—90, Pl. 36.

Mus L. (excl. of several species). Incisors almost always smooth in front. Molars $\frac{3-3}{3-3}$, enamelled uniformly, obtusely tuberculate, the premolar the largest of all. Ears rounded, somewhat naked, exsert. Fore feet tetradactylous, with hallucar wart unguiculate, hind feet pentadactylous. Dental formula, i. $\frac{1-1}{1-1}$, p. $\frac{1-1}{1-1}$, m. $\frac{2-2}{2-2}=16$.

A. *Tail thinly haired, ringed with scales in whorls, mostly long.*

† *With internal buccal pouches.*

Cricetomys WATERHOUSE. Head protracted. Tail long.

Sp. *Mus goliath* RUEPPELL, *Cricetomys gambianus* WATERHOUSE, *Proceed. of the Zool. Soc.* 1840, pp. 1, 2. RUEPP. *Mus. Senckenb.* III. s. 114, Tab. 9, Tab. 10, fig. 1 (cranium). A very large rat from West Africa; greyish-red; belly, toes, and tip of tail white.

Saccostomus PETERS. Tail somewhat short, obscurely annulate, thinly haired.

Sp. *Saccostomus lapidarius* PETERS, *Reise nach Mossambique, Zool.* I. Taf. 34, fig. 3, &c.

†† *With buccal pouches none.*

Mus (in stricter sense). Incisors smooth in front.

Sp. *Mus Rattus* L., BUFF. VII. Pl. 36, SCHREB. *Säugth.* Tab. 179; the *rat, house-rat, black rat;* black-grey on the back; fur glossy; tail of the length of the body. The ancients were not acquainted with this animal; according to some this species was imported from America; others suppose it to have come from the East.—*Mus decumanus* PALL., BUFF. VIII. Pl. 27, SCHREB. *Säugth.* Tab. 178; the *brown rat, le surmulot* (BUFF.), *die Wanderratte;* brownish-grey; tail shorter than the body. This species, which first penetrated into Western Europe from the East in the middle of the last century (compare BUFFON, VIII. p. 206), is now in many countries more common than the preceding, which has been expelled by it; it surpasses

this somewhat in size.—*Mus musculus* L., BUFF. VII. Pl. 39, *Suppl.* III. Pl. 30, p. 182, SCHREB. *Säugth.* Tab. 181, CUV. *R. Ani., éd. ill., Mammif.* Pl. 58, fig. 1; the *mouse, la souris, die Hausmaus.* These three species have been dispersed with man over nearly the whole world.—*Mus minutus* PALL., *Mus pendulinus* HERM. (and *M. soricinus* and *parvulus* ejusd.[1]), PALL. *Glir.* Tab. 24 B; still smaller than the house-mouse and with shorter tail; light ruddy-coloured, white below. This species builds in corn-fields a nest of straw and leaves, which it suspends, and in which the female suckles and nurses her young. See a figure of GLOGER *Nov. Act. Acad. Cæs. Leop. Car.* XIV. Tab. 23.—*Mus sylvaticus* L., BUFF. VII. Pl. 41, SCHREB. *Säugth.* Tab. 180, the *field-mouse, le mulot;* reddish-grey, white below; somewhat smaller than the house-mouse; this species sometimes multiplies so greatly as to cause much damage to the crops. It has the legs, and especially the hind legs, longer, and moves by jumps. It makes the transition to *Meriones* ILLIG.

The largest known species of this genus is *Mus giganteus* RAFFLES, *Linn. Transact.* VII. Pl. 18, from Bengal and Coromandel, which attains a length of fully two feet. Some species have (especially on the hind part of the back) spines dispersed under the hair. Here belong *Mus cahirinus* GEOFFR., LICHTENSTEIN *Darstell. neuer od. wenig bek. Säugth.* Tab. 37, fig. 1, *Mus dimidiatus* CRETSCHM., RUEPP. &c. They form the sub-genus *Acomys* of ISID. GEOFFR. SAINT-HILAIRE. In a new species from Mosambique the spines commence even on the head (*Mus spinosissimus* PETERS, *Mossamb., Zool.* I. p. 160, Pl. 34, fig. 1).

Steatomys PETERS. Upper incisors furnished in front with a longitudinal groove. Tail somewhat short.

Pelomys PETERS. Upper incisors grooved. Tail elongate. Outer toe both before and behind short.

On these African sub-genera consult PETERS l. l. pp. 157—159 and pp. 162—166.

Dendromys SMITH. Upper incisors grooved. Fore feet with three toes and hallucar wart. Tail long, thinly haired, ringed.

Sp. *Mus mesomelas* LICHTENST., *Dendromys typicus* SMITH, &c. Comp. SMITH *Zool. Journ.* XVI. 1829, *Bulletin des Sciences nat., Août,* 1829, p. 275, BRANTS *Muizen,* bl. 122—124.

Note.—On other sub-genera, here omitted (*Pseudomys* GRAY, *Proceed. Zool. Soc.* 1832, p. 39, *Akodon* MEYEN, &c.), comp. WAGNER in SCHREB. *Säugth., Supplementband,* 3tte Abth.

B. *Tail densely haired.*

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[1] DE SELYS-LONGCHAMPS *Études de Micromammalogie,* Paris, 1839, 8vo, pp. 68, 69.

Phlœomys WATERH. Ears moderate, hairy. Bristles very long. Fore feet tetradactylous with hallucar wart, with nail flat; hind feet pentadactylous. Claws compressed, incurved, large. Tail shorter than body.

Sp. *Phlœomys Cumingi* WATERHOUSE, *Proceed. of the Zool. Soc.* VII. 1839, pp. 107, 108; from the Philippine Islands; a large species, blackish-brown, with a red tint on the back; tail black; length 19″, tail 13″ or 14″. Its external air withdraws this species from the genus *Mus*, with which, however, it agrees in the teeth (which I have not been able myself to examine).

Sminthus NATHUSIUS, BLAS. and KEYSERL. Molar teeth $\frac{4-4}{3-3}$, tuberculate. Upper lip not cloven. Tail long, hairy. (Feet and habit of the mice.)

Sp. *Sminthus loriger* NATH., *Sminthus Nordmanni* BLAS. and KEYSERL.;—*Sminthus betulinus* NILSSON, *Mus betulinus* PALL. *Glir.* Tab. 22, fig. 1; comp. NILSSON *Skandinavisk Fauna*, I. Lund. 1847, pp. 332—335.

BRANDT (*Bemerkungen ueber die Wirbelthiere des nordl. Russland*, s. 35) unites all these species under the name *Sminthus subtilis;* BLASIUS, believing them likewise to form only one species, calls it *Sminthus vagus. Fauna Deutschl.* 1857, I. s. 304.

Perognathus NEUW. Molar teeth $\frac{4-4}{4-4}$, tuberculate; upper incisors grooved. Buccal pouches external, ample. Tail long, thin, verticillate with scales, and haired. (Feet and habit of mice.)

Sp. *Perognathus fasciatus* MAXIM. PRINZ ZU WIED, *Nov. Act. Acad. Cæs. Leop. Carol.* XIX. 1, pp. 368—374, Tab. 34; North America.

Cricetus CUV. Incisor teeth smooth in front, lower compressed, molars $\frac{3-3}{3-3}$, uniformly enamelled, tuberculate. Ears exsert, rounded. Buccal pouches internal. Fore feet with four toes and hallucar wart, hinder pentadactylous. Tail very short, hairy.

Sp. *Cricetus vulgaris* DESMAR., *Cricetus frumentarius* PALL., *Mus cricetus* L., BUFF. XIII. Pl. 14, SCHREB. *Säugth.* Tab. 198, GUÉR. *Iconogr., Mammif.* Pl. 26, fig. 2; the *hamster;* greyish-yellow or ruddy above, black below; the nose, under jaw and legs white; three large, whitish-yellow spots on each side, at the fore part of the body; sometimes almost quite black. This animal lives in Siberia, Russia, Germany, especially in Thuringia, in holes under ground, and hoards there large stores of corn; it sleeps through the winter, but less deeply than the marmots. Compare F. G. SULZER *Versuch*

einer Naturgesch. des Hamsters. Mit Kupf. Göttingen u. Gotha, 1774, 8vo. PALLAS discovered various other small species of this genus in Siberia, as *Cricetus songarus* PALL. *Glir.* Tab. 16 B, *Cricetus arenarius* PALL. *Glir.* Tab. 16 A, &c.

Hapalotis LICHTENST., *Conilurus* OGILBY. Incisor teeth smooth, coloured, molars $\frac{3-3}{3-3}$, tuberculate. Ears long, oval, with short hair. Bristles very long. Feet pentadactylous, anterior with pollex very short, resembling a wart, with claw small; posterior long, saltatory, with three middle toes long, subequal; claws incurved, compressed. Tail long, tufted at the extremity with longer hair:

Sp. *Hapalotis albipes* LICHTENSTEIN, *Darstellung der Säugth.* Tab. 29; *Conilurus constructor* OGILBY, *Transact. of the Linn. Soc.* XVIII. p. 125, *Hapalotis constructor* GOULD, *Mamm. of Austr.* II. Pl. 8; grey, brown on the back, whitish below; tail brown, white below. This species builds a conical nest of twigs, resembling a beehive;—*Hapalotis Mitchellii, Dipus Mitchellii* OGILBY, GOULD l. l. I. Pl. 15, KRAUSS l. l. Tab. 20, fig. 11; much smaller than the preceding. Compare on this singular genus, which recalls the similarly formed genus *Dipus* of Australia, GRAY in *Ann. of nat. Hist.* II. 1839, pp. 307—309.

Meriones ILLIG., *Gerbillus* DESMAR. Upper incisors indented almost always by a longitudinal groove. Molars ($\frac{3-3}{3-3}$ equably enamelled), furnished with transverse hills forming, when worn, oval figures, like lamellæ, surrounded by enamel. Ears exsert, oval. Head protracted, acuminate in front. Fore feet with four toes and hallucar wart, hinder pentadactylous, with tarsus and toes elongate. Tail long, hairy, often pencilled towards the tip.

Sp. *Meriones pyramidum* WAGN., *Dipus pyramidum* GEOFFR., GUÉR. *Iconogr., Mammif.* Pl. 26, fig. 1, North Africa;—*Meriones tamaricinus* KUHL, *Dipus tamaricinus* PALL. *Glir.* Tab. 19 (copied in SCHREB. Tab. 232), at the Caspian Sea, &c. A tail with short hair and without a tuft at the tip, occurs in *Meriones Schlegelii* from the Cape of Good Hope, SMUTS *Enum. mamm. capens.* Tab. I.

(Here belong the genera *Rhombomys* WAGNER and *Psammomys* CRETSCHMAR, RUEPPELL, the last with upper incisors not grooved.)

Compare on this genus F. CUVIER *Mémoire sur les Gerboises et les Gerbilles, Transact. of the Zool. Soc.* II. 2, 1838, pp. 135—148, Pl. 22—26; SUNDEVALL in *k. vetensk. Ac. Handl.* 1842, pp. 226—235, Tab. II. These animals do not spring on their hind feet, like all the species of *Dipus* (see below), with which they were formerly incorrectly associated.

Saccomys F. Cuv. Incisor teeth smooth in front, molars $\frac{4-4}{4-4}$, complex. Buccal pouches external. Ears exsert, somewhat large. Feet pentadactylous; pollex of fore feet short, with nail small, flat. Tail elongate, annulate, thinly haired.

Sp. *Saccomys anthophilus* F. Cuvier, *Mém. du Mus.* x. pp. 419—428, Pl. 26. This animal, probably of American descent, is, apparently, known from the description of a single specimen only. It differs entirely from *Mus bursarius* with which Fischer (*Addenda, Emendanda et Index ad Synops. Mamm.* p. 592) wished to unite it.

Hesperomys Waterh., Wagn. Incisors smooth in front, coloured; molars $\frac{3-3}{3-3}$, complex, with tubercles in two rows, the crown being entire, with folds of enamel more or less alternating when worn. Ears moderate or somewhat large, exsert. Feet pentadactylous, with pollex short, or the fore feet with hallucar wart unguiculate. Tail moderate or long, with short hair or somewhat naked.

Until within a few years some species only of Mice from the New World were known; these have been since increased by many species, especially from South America, which almost agreeing externally with the species of the genus *Mus*, differ however from them altogether in the structure of the molar teeth; as has been shewn by Waterhouse *Proceedings of the Zool. Soc.* v. 1837, pp. 15—21, and *The Zoology of the Voyage of the Beagle, Mamm.* 1839.

Sp. *Hesperomys nasutus* Waterh. *Voyage of the Beagle, Mamm.* Pl. 17, fig. 2;—*Hesperomys hispidus, Oxymycterus hispidus* Pictet, *Notice sur les animaux nouv. du Musée de Genève*, 2e Livrais. 1843, Pl. 10;—*Hesperomys elegans* Waterh., *Eligmodontia typus* F. Cuv. *Ann. des Sc. nat.*, Sec. Sér. Tom. vii. 1837, p. 168, Pl. 5;—*Hesperomys Darwinii* Waterh. *Voy. of the Beagle, Mamm.* Pl. 23;—*Hesperomys anguya, Mus anguya* Desm., Pictet l. l. 3ième et 4ième Livr. Pl. 15.

Holochilus Brandt. Upper lip not fully cloven, a fold of skin uniting the fissure below. Sp. *Hesperomys leucogaster, Mus* (*Holochilus*) *leucogaster* Brandt, *Mamm. exot. Musei Acad.* Petropoli, 1835 (*Mém. de l'Acad. de St. Pétersbourg*, vi. Série, *Sc. math. et phys.* Tome iii. 2, Tab. 12).

Rithrodon (*Rheithrodon*) Waterh. Upper incisors indented by a longitudinal groove.

Sp. *Hesperomys cuniculoides, Reithrodon cuniculoides* Waterhouse, *The Zoology of the Voy. of the Beagle, Mamm.* Pl. 26; with two other species in the most southern part of South America.

Neotoma SAY and ORD. Incisors smooth, yellow in front; molars $\frac{3-3}{3-3}$, complex. Ears exsert, somewhat large, oval. Feet pentadactylous. Tail long, clothed with long hair.

Sp. *Neotoma Drummondii*, RICHARDSON *Fauna bor. Amer., Mamm.* p. 137, Pl. VII. (VIII.), North America; the *habitus* resembles that of *Myoxus* or *Chinchilla*, more than that of *Mus*;—*Neotoma floridanum* SAY.

Sigmodon SAY and ORD.

Sp. *Sigmodon hispidum* SAY and ORD, *Arvicola hortensis* HARLAN *Faun. Am.* (a species unknown to me).

Hypudæus ILLIG. (in part), *Arvicola* LAC., CUV. Incisor teeth smooth, molars $\left(\frac{3-3}{3-3}\right)$ complex, with folds of enamel describing triangles, alternating in a double row on the surface of the crown. Ears moderate or small, rounded, almost concealed under the hair of head. Fore feet tetradactylous with hallucar wart, hinder pentadactylous; claws small; soles naked. Tail moderate or somewhat short, hairy. Dent. form. OWEN, i. $\frac{1-1}{1-1}$, p. $\frac{1-1}{1-1}$, m. $\frac{2-2}{2-2}$ = 16.

Sp. *Hypudæus amphibius* ILLIG., *Mus terrestris et amphibius* L., BUFF. VII. Pl. 43, SCHREB. *Säugth.* Tab. 186, CUV. *R. Ani., éd. ill., Mamm.* Pl. 58, fig. 3; the *water-rat, le rat d'eau;* 7″ long besides the tail, which is 3″ or more long; brownish, grey below; as varieties of this species are regarded *Mus terrestris* (L?) HERMANN, which is smaller, *Arvicola destructor* SAVI and *Arvicola monticola* DE SELYS-LONGCH.—*Hypudæus arvalis, Mus arvalis* PALL., BUFF. VII. Pl. 47, SCHREB. *Säugth.* Tab. 191; the *field-campagnol, meadow-mouse,* of the size of a mouse; tail only one-third the length of the body; colour yellowish-grey, below whitish-grey. This species is, like *Mus sylvaticus,* very numerous in some years, so as almost to destroy the harvest; such was the case in 1818 and 1819 in Holland and elsewhere; see C. NICATI *Commentatio de Mure domestico, sylvatico atque arvali* in *Annal. Acad. Rheno-Traject.* 1823.

Hypudæus œconomus ILLIG., *Mus œconomus* PALL., SCHREB. *Säugth.* Tab. 190; GUÉRIN *Iconogr., Mammif.* Pl. 26, fig. 3; this species, at home in Siberia, lays up a great quantity of roots, &c. against winter, and travels away at indeterminate times in numerous troops.

Compare on this genus DE SELYS-LONGCHAMPS *Études de Micromammalogie*, 1839, pp. 81—132; the same in *Revue zoolog.* 1847, pp. 305—312, and GERBE *Revue et Magas. de Zool.* 1852, pp. 257—270, 305—312, 449—460, Pl. 11, 13, 14, 18, 19.

Myodes PALL. (in part), BLAS. and KEYSERL., *Lemmus* LINK, DESMAR., BRANTS. Ears hidden beneath the fur. Soles hairy. Fore feet with fossorial claws. Tail very short, hairy.

Sp. *Hypudæus lemmus* ILLIG., *Mus lemmus* L., *Museum Wormianum*, 1655, fol. p. 325 (fig. of animal and skeleton), PALL. *Glir.* Tab. XII. A, SCHREB. *Säugth.* Tab. 195 A, CUV. *R. Ani., éd. ill., Mammif.* Pl. 59, fig. 1; the *lemming* or *Northern mouse of passage;* 5″ to 6″ long, above ruddy-yellow, on the top of the head and neck black, below pale ash-coloured. This animal lives on the mountains of Norway and Sweden, and travels to other regions in multitudes, which eat every thing bare on their road, like locusts. This usually forbodes a hard winter. The number of these animals, thus suddenly appearing in situations where they were previously unknown, gave occasion in former times to the strange opinion that they descended from the clouds. *Mus. Worm.* p. 321;—*Hypudæus migratorius* ILLIG., *Lemmus obensis* BRANTS, PALL. *Glir.* Tab. XII. B, SCHREB. *Säugth.* Tab. 195 B, &c. Here is to be placed *Georychus luteus* EVERSMANN, *Bullet. de la Soc. imp. des naturalistes de Moscou*, 1840, p. 25, Tab. 2, a species nearly allied to *Lammus obensis*, but distinct according to MIDDENDORFF.

Fiber CUV., ILLIG. Ears hairy, short. Claws compressed, incurved. Toes of hind feet long, bordered at the sides by long, thick, shining hair. Tail longer than half the body, compressed, two-edged toward the extremity, scaly, covered with short, thin hair. (Other characters nearly of *Hypudæus.*) Dent. form. OWEN, i. $\frac{1-1}{1-1}$, p. $\frac{1-1}{1-1}$, m. $\frac{2-2}{2-2} = 16$.

Sp. *Fiber zibethicus* CUV., *Castor zibethicus* L., BUFF. X. Pl. 1, SCHREB. *Säugth.* Tab. 176, CUV. *R. Ani., éd. ill., Mammif.* Pl. 58, fig. 2; the *ondatra* (name with the *Hurons*); length of the body fully 1 foot, without the tail, which is from 8 to 9 inches long; the colour usually ruddy-brown, on the top of the head and back darker, in some specimens dark brown. This animal is found from 30° to 69° in North America, lives in grassy marshes and lakes, and on the banks of sluggish rivers. Four or five hundred thousands of skins are annually imported into England, and used in making hats.

Euryotis BRANTS, WAGN., *Otomys* F. CUV. Upper incisors (and mostly lower also) indented by a longitudinal groove. Molar teeth composed of transverse lamellæ. Ears somewhat large, rounded, ample. Tail moderate, thinly haired. (Feet and habit of mice.)

Sp. *Euryotis irrorata* BRANTS *Muizen*, p. 94 (and plate at the end of the work), SMITH *Ill. of the Zool. of S. Afr., Mamm.* Pl. 22, *Otomys bisulcatus* F. CUV., *Mammif.* Livr. 61;—*Euryotis unisulcata* SMITH, F. CUV. l. l. Livr. 60, &c. Mice of South Africa; of the teeth F. CUVIER gave a description and figure, *Des Dents des Mammif.* Pl. 60, pp. 168, 169.

Note.—Allied to this genus are *Otomys* SMITH (not CUV., *Malacothrix* WAGN.) and *Mystromys* WAGN. Comp. SCHREBER'S *Säugth., Supplementband,* 3te Abth. s. 496—501.

Family XXVII. *Cuniculoria* (*Georhychi* WIEGM.). Incisors exsert, cuneate, with apex truncated, straight; molars mostly $\frac{4-4}{4-4}$, more seldom $\frac{3-3}{3-3}$. Feet pentadactylous, cloven. Ears none, or in a few very short. Eyes small, sometimes concealed by skin. (Body thick, head obtuse, tail short or none.)

Rhizomys GRAY, *Nyctocleptes* TEMM. Incisors broad, smooth in front, with red enamel, molars $\frac{3-3}{3-3}$, small, complex. Head broad, short, truncated anteriorly. Ears very small, rounded. Eyes small, placed towards the upper surface of head. Fore feet tetradactylous, with hallucar wart unguiculate; claws short. Tail short.

Sp. *Rhizomys decan* nob., *Nyctocleptes decan* TEMM., TEMMINCK in *Bijdragen tot de Natuurk. Wetenschappen,* VII. 1832, bl. 1—8, Pl. 1, *Monogr. de Mammal.* II. pp. 40—45, Pl. 33, *Mus Sumatrensis* RAFFL., LINN. *Trans.* XIII. 258? *Rhizomys Sumatrensis* and *Rh. Sinensis* GRAY, *Proceed. Zool. Soc.* I. 1830—1831, p. 95; an animal of the size of a rabbit that feeds on the roots of the bamboo-cane; it has not been observed at Sumatra, but in Malacca and China.—WAGNER refers to this genus also *Bathyergus splendens* RUEPPELL, a small species from Abyssinia, with ears more developed and in some degree a different *habitus;* RUEPPELL *Neue Wirbelthiere,* Tab. 12, KRAUSS l. l. Tab. 20, fig. 2. The skull and the teeth appear to support this opinion.

Ctenomys BLAINV. Incisor teeth smooth, orange-coloured, molars $\frac{4-4}{4-4}$, destitute of roots, simple, decreasing in size from the first to the last, which is small, with crown of the upper obliquely lunate, concave outwards, of the lower oval. Ears small. Tail somewhat short, clothed with appressed hair. Rigid, incurved hairs at the base of claws. (Dent. form. OWEN, i. $\frac{1-1}{1-1}$, p. $\frac{1-1}{1-1}$, m. $\frac{3-3}{3-3} = 20$).

Sp. *Ctenomys brasiliensis* BLAINV., KRAUSS l. l. Tab. 20, fig. 5 (from the figure in D'ORBIGNY'S Voyage);—*Ctenomys magellanicus* BENNETT, *Trans. of the Zool. Soc.* II. Tab. 17, WATERHOUSE *Mamm.* II. Pl. 9, fig. 2.

Spalacopus WAGL., *Poephagomys* F. CUV., *Psammoryctes* POEPPIG, WAGN. Incisor teeth smooth; molars $\frac{4-4}{4-4}$, destitute of roots, simple, narrowed in the middle on each side, hence bipartite. Ears small. Tail short. Claws compressed, incurved.

Spalacopus noctivagus, Psammoryctes noctivagus POEPP., *Poephagomys ater* F. CUV. *Ann. des Sc. nat.* 2e Série, *Zool.* I. 1835, p. 321, Pl. 13, WATERH. *Mamm.* II. Pl. 9, fig. 1, GUÉR. *Magas. de Zool.* 1836, *Mamm.* Pl. 20.

Schizodon WATERH. (Scarcely different, except in the ears a little larger.)

Sp. *Schizodon fuscus* WATERH. *Mamm.* II. Pl. 11, fig. 2; a species which, like the *Georychi* of the Cape, burrows under ground; it is found in the southern part of the Andes-range.

Georychus ILLIG. (in part), mihi, WIEGM., *Bathyergus* F. CUV. (spec. of *Bathyergus* G. CUV.). Incisors short, molars simple $\frac{4-4}{4-4}$ or often $\frac{3-3}{3-3}$, with the last developed late, the first least of all. Eyes small. Ears none. Claws of fore feet small. Tail short.

Sp. *Georychus capensis* ILLIG., *Mus capensis* PALL. *Glir.* Tab. 7 (fig. copied in SCHREB. *Säugth.* Tab. 204), BUFF. *Suppl.* III. Pl. 33, p. 194, VI. Pl. 36, p. 252, *la petite taupe du Cap.* This animal, of the size of a rat, is greyish, with head black and often white on the nose, near the auditory passages, above the eyes and on the middle of the occiput. This burrowing mouse lives at the Cape of Good Hope, in the gardens of Cape Town and in the fields further in the interior. ("F. CUVIER and ILLIGER ascribe to this animal 3 molars; in one skull, however, I counted 4. The first, the largest in *Bathyergus*, is here the smallest." *Handb. der Dierk.* first edit. II. p. 611).—The eyes are very small in *Georychus holosericeus* WAGN., according to PETERS it does not differ from *Bathyergus cæcutiens* LICHTENST., BRANTS *Muizen* bl. 37.

Heliophobius PETERS. (A genus scarcely distinct from *Georychus* except in the molar teeth $\frac{6-6}{6-6}$?)

Sp. *Heliophobius argenteo-cinereus,* PETERS *Reise nach Moss., Säugth.* pp. 139—145, Tab. 31, fig. 2.

Note.—Whether this be the place for *Ellobius* FISCHER, *Chtonoërgus* NORDMANN, I scarcely venture to determine.

Sp. *Mus talpinus* PALL. *Glir.* Tab. XI. A. Comp. WAGNER in SCHREB. *Säugth., Supplementband,* 3te Abth. pp. 362, 364, and the authors there cited.

Spalax GULDENSTAEDT[1], ILLIG., CUV. Incisors very large, exsert, molars $\frac{3-3}{3-3}$, complex, small, the first larger than the rest. Head broad, flat above, truncate anteriorly. Eyes very small, hidden under the hairy skin. Ears none. Feet short, with claws small. Fur soft. Tail none.

Sp. *Spalax typhlus, Mus typhlus* PALL. *Glir.* Tab. VIII. (copied in SCHREB. *Säugth.* Tab. 206); GUÉR. *Iconogr., Mammif.* Pl. 27, fig. 2; the *zemni* (*slepez* is the Russian name); 8″ big, lives underground like a mole, and bites round about powerfully: one who has pressed this animal in his hand till it dies, and has been bitten by it, has acquired (according to popular belief in the Ukraine) the wonderful power of curing the goitre by laying on his hands[2]. This animal is found in Southern Russia from the Wolga to the borders of Poland and in Hungary.

According to the investigations of KESSLER the supposed larger species, noticed by PALLAS, of 10 to 11 inches, and which has no lateral folds on the crowns of the molars (*Ommatostergus Pallasii* NORDMANN, KEYSERL. *u.* BLASIUS *Wirbelthiere Europa's,* s. VII. 11, 31, figured in the work of DEMIDOFF and copied by KRAUSS, op. cit. Pl. 20, fig. 1) is merely a variety depending on age. *Bullet. de la Soc. imp. de Moscou,* XXIV. 1851, p. 127.

Siphneus BRANTS (spec. of *Georychus* ILLIG. and CUV.). Eyes very small, conspicuous. Fore feet with claws of three middle toes compressed, incurved, large, that of the third toe particularly long. Tail short. (Other characters of the preceding genus.)

Sp. *Siphneus Aspalax, Mus Aspalax* PALL. *Glir.* Tab. X. copied in SCHREB. *Säugth.* Tab. 205), KRAUSS l. l. Tab. 20, fig. 6; the *Zokor,* Siberia.

Bathyergus ILLIG., *Orycterus* F. CUV. Incisors very large, exsert, upper indented by a longitudinal groove; molars $\frac{4-4}{4-4}$, complex, bipartite from a transverse streak of enamel; crown of worn teeth flat, surrounded by a single circle of enamel. Eyes small. Ears none. Fore feet with large, fossorial claws, the claw

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1 *Novi comment. Acad. Petrop.* XIV. P. 1, p. 409.

2 "*Itaque decantata virtus Regum Galliæ apud Ukranos admodum obvia et vilis est nec spero minus efficax, si quid imaginationis vires in istos morbos valent.*" PALL. *Glir.* p. 158.

of second toe largest of all. Tail short. (Dent. form. OWEN, i. $\frac{1-1}{1-1}$, p. $\frac{1-1}{1-1}$, m. $\frac{3-3}{3-3}=20$.)

Sp. *Bathyergus maritimus* ILLIG., *Mus maritimus* GMEL., *Mus suillus* SCHREB., BUFF. *Suppl.* VI. fig. 38 (fig. of ALLEMAND from the Dutch edit. of BUFFON), SCHREB. Tab. 204 B, GUÉR. *Iconogr., Mamm.* Pl. 38, fig. 3, the skeleton figured in PANDER *und* D'ALTON *Vergl. Osteolog.*, Heft VI. Tab. 3; the *sand-mole;* this animal lives in sandy countries and on the sand-hills at the Cape of Good Hope; it feeds on roots, like the other species of this family.

Ascomys LICHTENST., *Saccostomus* KUHL, *Pseudostoma* SAY, *Orycteromys* or *Oryctomys* BLAINV. Molar teeth $\frac{4-4}{4-4}$, destitute of roots, subcylindrical. Ears very short, rounded. Eyes small. Buccal pouches large, deep (when empty received in a cutaneous fold, opening downwards by a long fissure at the inferior margin of jaw). Fore feet fossorial, with middle three claws long, incurved, the third longest of all. Tail short.

a) *With upper incisors deeply indented in the middle by a longitudinal groove.*

Sp. *Ascomys canadensis* LICHTENST., *Mus bursarius* SHAW, *Geomys bursarius* RICHARDSON, SHAW *Transact. of the Linn. Soc.* V. p. 227, Tab. VIII. (copied in DESMAREST *Encycl. méth., Mamm. Pl. Suppl.* X. fig. 4); LICHTENSTEIN *Ueber die äussere Backentasche der Nagethiere, Abhandl. der Akad. der Wissensch. zu Berlin*, VII. 1825, S. 13—20, Tab. 2; red-brown; trunk full 8″, tail 3″ long; this animal lives in Canada. (In SHAW'S figure the buccal pouches are inverted, hanging down on each side of the head).—*Ascomys mexicanus* LICHTENST.; shining dark-brown.

b) *With upper incisors marked by a very thin lateral groove or quite smooth. Thomomys* MAXIM.

Sp. *Ascomys bulbivorus, Diplostoma bulbivorum* RICHARDS. *Faun. bor. Amer., Mamm.* Pl. 18 B, copied in KRAUSS l. l. Tab. 20, fig. 7; *Ascomys rufescens* WAGN., *Thomomys rufescens* MAXIM. NEUW., *Oryctomys Bottæ* EYDOUX *et* GERVAIS (GUÉRIN *Mag. de Zool.* 1836, *Mamm.* Pl. 21, fig. 4, fig. of teeth), in WAGNER'S opinion.

Haplodon WAGL., WAGN., *Aplodontia* RICHARDSON.

Sp. *Haplodon leporinus, Aplodontia leporina* RICHARDS. *Zool. Journ.* 1829, p. 335, *Faun. bor Amer.* I. p. 211, Tab. 18 C, figs. 7—14, *Arctomys rufa* HARLAN, *Fauna Americana*, Philadelphia, 1825, p. 208; hab. the west of North America near the river Columbia. The animal unknown to me,

with molars $\frac{5-5}{4-4}$, the first upper small, with buccal pouches none, according to DOUGLAS, with claws of fore feet very long, tail very short.

Family XXVIII. *Muriformia* (*Psammoryctina* WAGN. in part, *Orycterina* WIEGM.) Incisors with apex truncated, straight. Molars almost always $\frac{4-4}{4-4}$. Feet pentadactylous or tetradactylous, congruous. Ears moderate, sometimes large.

This family contains some rodents, principally from South America, which cannot well be referred to any of the other families, but is not sharply defined. Under a future improved arrangement of the *Glires*, for which the time appears not yet to have arrived, and which may be much more simple than is now supposed, this family will doubtless be dropped.

Ctenodactylus GRAY. Incisors white, smooth; molars $\frac{3-3}{3-3}$, the upper with crown oblong, emarginate externally, the lower with crown narrowed on each side, oblique. Ears small. Whiskers long. Feet tetradactylous; inner toe of hind feet furnished with a horny comb; rigid, curved hairs concealing the small compressed claws. Tail very short.

Ctenodactylus Massonii GRAY, *Spic. Zool.* Tab. 10; Tripoli; yellowish-grey, resembling a lemming externally. Comp. YARRELL's elaborate description, *Proceedings of the Zool. Soc.* 1830—1831, pp. 48—50.

Petromys SMITH. Incisors smooth, pale yellow; molars $\frac{4-4}{4-4}$, with crown divided into two transverse, oval lamellæ, the upper folded internally, the lower externally. Ears small, rounded. Whiskers long, numerous. Feet pentadactylous, with pollex short; claws incurved, small, compressed. Tail elongate, clothed with rigid hair, longer towards the extremity.

Sp. *Petromys typicus* SMITH *Zool. of S. Afr., Mamm.* Pl. 20, WATERH. *Mamm.* 2, Pl. 17, fig. 1; of the size of a rat, red-brown, tail blackish.

Cercomys F. CUV. Molar teeth $\frac{4-4}{4-4}$, complex. Head protracted in front of mouth. Ears ample, somewhat naked. Whiskers long. Fore feet tetradactylous, with thumb-wart unguiculate,

hinder pentadactylous; outer toe short both before and behind. Tail long, annulate, thinly haired.

Sp. *Cercomys cunicularius* F. Cuv. *Mammif.*, Livr. 60, *Nouv. Ann. du Mus.* I. 1832, pp. 449—452, Pl. 18, fig. 1 (molar teeth), Pl. 19, figs. 1, 2 (cranium), Hab. in Brasil.

Loncheres Illig., *Echimys* Geoffr. (*Echinomys* more correctly Wagn.). Incisor teeth smooth; molar $\frac{4-4}{4-4}$, complex. Whiskers long, numerous. Spines almost always intermixed with hairs on the back, lanceolate, flat, or concave above. Fore feet tetradactylous, with thumb-wart unguiculate, hinder pentadactylous. Claws short, compressed, incurved. Tail long, annulate, more or less hairy.

Compare on this genus of South American rodents Isid. Geoffr. Saint-Hilaire *Notice sur les Rongeurs épineux* in Guérin *Magas. de Zool.* 1840, *Mammif.* pp. 1—57, Pl. 20—29.

Dactylomys Isid. Geoffr. Fore feet tetradactylous. Two middle toes of fore feet and three middle toes of hind feet much longer than the lateral toes. Tail long, annulate, thinly haired except the base. Spines none. (Each molar tooth composed of two parts divided by a transverse groove; crown of upper molars divided into two triangles, with the acute apex internal, emarginate externally, crown of lower with first part triangular, incised internally, the other part oval.)

Sp. *Echimys dactylinus* Desmar., *Dactylomys typus* Isid. Geoffr. l. l. Pl. 20, Deville in Guérin *Revue et Magas. de Zool.* 1852, pp. 354—357;—*Dactylomys emblyonyx* Natterer, Wagn.

Echinomys (Isid. Geoffr.), Wagn. Characters of the genus. Ears elongate, acuminate. Tarsi elongate, narrow. Molar teeth small, with crown rounded. Spines in adults, mostly mixed with hair.

Sp. *Loncheres cayennensis* (Fisch.), *Echimys cayennensis* Geoffr., Desmar., *Loncheres myosurus* (and *leptosoma*) Lichtenst., Guér. *Iconogr., Mammif.* Pl. 24, fig. 3, Waterh. *Mamm.* II. Pl. 19, fig. 2. (Younger individuals, that had not got spines, occasioned the adoption of a distinct species, *Echimys setosus* Geoffr., Desm., Isid. Geoffr. l. l. Pl. 25. Compare Pictet *Notice sur les Ani. nouv. du Mus. de Genève*, IIe Livr. Pl. 1—3);—*Loncheres antricola, Nelomys antricola* Lund, *Kongel. Danske Vidensk. Selskabs Afhandl.* VIII. 1841, Pl. 23, &c. Individuals destitute of tail which occur not unfrequently in South America amongst these rodents, the loss

being caused probably by the sand-fleas (*Pulex penetrans*), have occasioned the genus *Mesomys* WAGN. See J. REINHARDT *Vidensk. Meddelelser fra den naturh. Forening i Kjöbenhavn*, 1849, 1850, pp. 110—115, BURMEISTER *Syst. Uebers. der Thiere Brasiliens*, 1854, s. 208, 209.

Nelomys JOURDAN, ISID. GEOFFR., *Loncheres* WAGN. Characters of the genus. Ears moderate, rounded. Tarsi somewhat short, broad. Molar teeth with crown oblong.

Sp. *Loncheres cristatus* ILLIG., BURM., *Echimys cristatus* GEOFFR., DESMAR., *Loncheres chrysurus* LICHTENST., BUFF. *Suppl.* VII. Pl. 72, (fig. and descr. of ALLEMAND), ISID. GEOFFR. l. l. Pl. 21, WATERH. *Mamm.* II. Pl. 17, fig. 2; in this large species the tail is hairy; other species have the tail nearly naked, like mice, as *Loncheres armatus* WAGN., *Mus hispidus* LICHTENST., &c.

Some species have no spines. Such a species with a hairy tail is *Lasiuromys villosus* DEVILLE, GUÉRIN *Revue et Magas. de Zool.* 1852, Pl. 15, pp. 360, 361.

Carterodon WATERH. Incisors broad, upper indented on the outer part by a longitudinal groove. Molars $\frac{4-4}{4-4}$, complex, crown quadrate and rounded, the upper with one internal and two external folds of enamel, the lower with one external fold and two internal. Ears small, rounded. Thumb-wart of fore feet with nail flat; the other claws incurved, concealed by rigid hair. Narrow spines, terminating in a very fine point, intermixed with hair. Tail hairy, moderate.

Many years ago skulls of a rodent with grooved incisors were found by LUND in caves of Brasil, which he referred to a species of *Echinomys*, and first named *Echinomys sulcidens*, but afterwards *Aulacodus Temminckii*. *Kongel. Danske Vidensk. Selskabs Afhandl.* IX. 1842, p. 136; WATERHOUSE formed from this a distinct genus *Carterodon* (*Mamm.* II. p. 351), but left it undetermined whether or no the animal was fossil only. At length J. REINHARDT obtained two living specimens of this animal, which he described in 1851 under the name of *Carterodon sulcidens*, *Vidensk. Meddelelser*, &c. 1851, pp. 23—26. See also BURMEISTER *Syst. Uebers. der Thiere Bras.* s. 209—211.

Aulacodus V. SWINDEREN, TEMM. Incisors broad, short, truncated, straight, brown in front, the upper trisulcate. Molar teeth $\frac{4-4}{4-4}$, complex, upper with three external folds and one internal. Ears somewhat short, rounded. Fore feet with thumb and outer

digit very short; hind feet tetradactylous; claws obtuse, rounded above, large. Body covered with hair flat and grooved above, or with flexile spines. Tail moderate or somewhat short, thinly haired.

Sp. *Aulacodus Swinderianus*, TEMMINCK *Monogr. de Mammal.* I. pp. 245—248, Pl. 25, *Esq. Zool. sur la côte de Guiné*, pp. 170, 171; WATERH. *Mamm.* II. Pl. 16; PETERS *Reise*, I. p. 138; in a great part of South Africa and on the coast of Guinea. This animal has an affinity with *Hystrix*, and in its size deviates from the spined rats (*Loncheres*).

Capromys DESMAR., *Isodon* SAY. Incisors smooth. Molars $\frac{4-4}{4-4}$, destitute of roots, complex, with two folds external in the upper, internal in the lower, and one fold on the opposite side. Ears moderate. Fore feet with a very short rudiment of thumb, the claw truncated, and with four toes, hind feet pentadactylous. Claws large, incurved. Tail moderate or long, covered thinly with hair.

Sp. *Capromys Fournieri* DESM., *Isodon pilorides* SAY *Journal of the Acad. of Nat. Sciences of Philadelphia*, II. p. 330, *Zool. Journ.* I. London, 1825, pp. 227—229, DESMAREST *Mém. de la Soc. d'Hist. nat. de Paris*, I. 1823, pp. 43—60, *Dict. univ. d'Hist. nat.* Pl. 150—152 (Livrais. III. No. 1, Livrais. XV. Nos. 5, 6, figure of the animal, its skeleton and skull); on the island of Cuba. This genus has unmistakeable affinity with *Myopotamus* (see above), and, like that genus, with *Cavia* also. On the anatomy OWEN gave a detailed notice, *Proceedings of the Zool. Soc.* 1832, pp. 68—76, pp. 100—103.—A smaller species with a longer tail is *Capromys Poeyi* GUÉRIN *Magas. de Zool.* 1834, *Mammif.* Pl. 15, *Iconogr., Mammif.* Pl. 25, fig. 12, which does not appear to be different from *Capromys prehensilis* POEPPIG. (I have not had an opportunity to consult the work of RAMON DE LA SAGRA on Cuba.) On the island of St Domingo an allied species occurs: *Plagiodonta œdium*, F. CUVIER *Ann. des Sc. nat.*, 2e *Série*, VI. *Zool.* 1836, Pl. 17, pp. 347—353. The folds of the molars are here placed more obliquely; the tail is short, scaly and naked.

Habrocoma WATERH. Incisors narrow, smooth. Molars $\frac{4-4}{4-4}$, destitute of roots, with crown of upper on each side sinuate internally with a fold of enamel, of lower with oblique folds describing triangles with the apex forward. Whiskers very long. Ears large, oval, somewhat naked. Fore feet tetradactylous, hinder pentadactylous. Tail moderate, fusiform, covered with close hair. Body covered by a dense fur of very soft hair.

This genus has some conformity with *Chinchilla*, even in the skull; the *bullæ tympanicæ* are particularly large; the skeleton has 17 pairs of ribs, the greatest number occurring in this order. Two species are known, both from Chili: *Habrocoma Bennettii* WATERH. *Voy. of H. M. S. Beagle, Mammal.* Pl. 28, and *Habrocoma Cuvieri*, Pl. 29.

Octodon BENNETT, *Dendrobius* MEYEN. Incisors smooth, molars $\frac{4-4}{4-4}$, destitute of roots, with crown oblique, with a fold of enamel on each side, sinuate internally. Whiskers numerous. Ears somewhat large, rounded, somewhat naked. Feet pentadactylous, the fore feet with pollex very small, resembling an unguiculate wart. Claws small, compressed, incurved, hidden by long hair, especially in the hind toes. Tail moderate or somewhat long, with tip mostly pencilled with long hairs.

Sp. *Octodon degus* WATERH., *Sciurus degus* MOLINA, GMEL., *Octodon Cumingii* BENNETT, *Dendrobius degus* MEYEN, *Nov. Act. Acad. Cæs. Leop. Car.* XVI. 2, pp. 600—602, Tab. 44, BENNETT *Transact. of the Zool. Soc.* II. 1, 1836, Pl. 16;—*Octodon Bridgesii* WATERH. This genus is nearly allied to the preceding, and also lives in Chili.

Family XXIX. *Eriomyina* (*Chinchillidæ* BENNETT.) Incisors smooth. Molars $\frac{4-4}{4-4}$, destitute of roots, composed of narrow transverse parallel lamellæ. Hind feet longer than fore feet. Tail furnished with long hair. (Clavicles perfect.)

This small group of South American mammals has been more accurately known and even for the most part discovered only within the last twenty years.

Eriomys CRETSCHMAR, LICHTENST., mihi. Molar teeth composed each of three lamellæ. Ears large, somewhat naked. Whiskers very long. Hind feet tetradactylous. Claws incurved, small, nearly hidden under the hair of toes. Body covered with very soft hair.

a) Fore feet pentadactylous. Ears large, rounded (*Eriomys* in stricter sense, *Chinchilla* BENNETT, WATERH.).

Sp. *Eriomys pellionum* mihi, *Mus laniger* MOLINA, GM., *Chinchilla* F. CUV. and GEOFFR. SAINT-HILAIRE, *Mammif.* Livr. 64, BENNETT *Gardens and Menag. of the Zool. Soc.* I. (October, 1829,) pp. 1—12; in Chili and Peru. The fur of the Chinchilla had been prized for some years for its fineness, before any thing determinate was known with regard to the animal and its position in the arrangement of mammals. Compare my paper in *Bijdragen*

tot de natuurk. Wetenschappen, VI. 1831, bl. 105—118, Pl. 2. (The opinion now prevails very generally that there are two species; one larger with shorter tail, *Chinchilla brevicaudata* WATERH., *Eriomys chinchilla* LICHTENST., WAGN., LICHTENST. *Darstellung*, Tab. 28, and *Chinchilla lanigera* WATERH., *Eriomys laniger* WAGN., *Eriom. pellionum* mihi, to which the figures of F. CUVIER and BENNETT refer.)

b) Fore feet tetradactylous. Ears elongate. *Lagidium* MEYEN, *Lagotis* BENNETT.

Sp. *Eriomys Cuvierii, Lagotis Cuvierii* BENNETT, *On the Chinchillidæ and a new Genus, Trans. of the Zool. Soc.* I. 1833, pp. 35—64;—*Eriomys peruanus, Lagidium peruanum* MEYEN, *Lagotis pallipes* BENNETT l. l. I. 4, 1834, pp. 331—334, Pl. 42.

Lagostomus BROOKES. Molar teeth formed of two transverse lamellæ, except the last upper formed of three lamellæ. Whiskers long, strong, numerous. Fore feet tetradactylous, hind feet tridactylous, with middle toe long, with claws long, compressed. Tail shorter than half the body, covered with longish hair.

Sp. *Lagostomus trichodactylus* BROOKES, *Linn. Transact.* XVI. 1, pp. 95—104, Tab. IX., LESSON *Ill. de Zool.* Pl. 8, WATERHOUSE *Mamm.* II. Pl. 5, fig. 1; the *Viscacha* (*Dipus maximus* BLAINV., DESMAR.); grey-brown, white below, a dark black spot along the cheeks; some longer black hair on the back and along the sides. This large rodent lives in South America, eastwards from the chain of the Andes to 41° S.L., in the plains (Pampas).

Family XXX. *Dipoda* WAGN. Molar teeth $\frac{4-4}{4-4}$, $\frac{4-4}{3-3}$ or $\frac{3-3}{3-3}$, complex, mostly supplied with roots. Fore feet short, hind feet elongate, saltatory. Tail long, furnished with long hair. Eyes large. Clavicles perfect. Infra-orbital foramen very large, placed in front of the orbit and resembling a second orbit.

Pedetes ILLIG., *Helamys* F. CUV. Incisors smooth, broad, the inferior with apex broad, truncated; molars $\frac{4-4}{4-4}$, without roots, with crown divided into two transverse, oval portions by a fold, external in the upper, internal in the lower. Ears elongate. Fore feet pentadactylous, with claws elongate, acuminate; hind feet tetradactylous, very long, with claws ungulæform. Tail long, tufted. (Dent. form. OWEN, i. $\frac{1-1}{1-1}$, p. $\frac{1-1}{1-1}$, m. $\frac{3-3}{3-3}=20$.)

Sp. *Pedetes cafer* ILLIG., *Mus cafer* PALL., *Dipus Cafer* SCHREB., GMEL., *Helamys capensis* F. CUV., BUFF. *Suppl.* VI. Pl. 41, pp. 269, 270 (fig. and descrip. of ALLEMAND), SCHREB. *Säugth.* Tab. 230, GUÉRIN *Iconogr., Mammif.* Pl. 28, fig. 1; *jumping hare*, in South Africa. This animal moves by wide leaps; it sleeps by day.

Dipus (ZIMMERMANN, SCHREB., GMEL. in part), ILLIG. (excl. of some spec.). Incisor teeth slender, acuminate, the upper grooved. Molars $\frac{3-3}{3-3}$, furnished with roots, complex, with a fold of enamel sinuate inwards at the surface of crown. Ears not longer than half the head. Fore feet pentadactylous, hind feet tridactylous. Tail long, hairy, with tip mostly tufted, and hair set in two rows (distichous). (Dent. form. OWEN, i. $\frac{1-1}{1-1}$, p. $\frac{1-1}{1-1}$, m. $\frac{2-2}{2-2}$ = 16.)

Sp. *Dipus sagitta* GM., SCHREB., *Mus sagitta* PALL. *Glir.* Tab. 21 (copied in SCHREB. *Säugth.* Tab. 229); between the Don and the Wolga, in the Southern Steppes at the Irtitsch. A very similar species lives in North Africa, *Dipus ægyptius* LICHTENST., *Mus ægyptius* HASSELQUIST, which species occurs in Egypt and Barbary, BUFF. *Suppl.* VI. Pl. 39, 40, CUV. *R. Ani., éd. ill., Mammif.* Pl. 60, fig. 1. See on the metatarsus, which consists of one bone only, above p. 566. The vertebræ of the short neck have, with the exception of the first, mutually coalesced. See DUVERNOY and LEREBOULLET *Mém. de la Soc. de Strasbourg*, III. 1842, Pl. III. (skeleton of *Dipus mauritanicus*, which DUVERNOY distinguishes from *D. ægyptius;* I observe the same coalescence in the skeleton of a specimen from Egypt). LINNÆUS united the North American and Asiatic species under the name of *Mus jaculus* (*Syst. nat.* ed. 12, I. p. 85).

Scirtetes WAGN., *Alactaga* F. CUV. Incisor teeth smooth; molars $\frac{4-4}{3-3}$, furnished with roots; first upper small, cylindric, the rest semi-complex with folds of enamel contorted. Feet pentadactylous, or hind feet tetradactylous, with three larger toes, insistent, one or two lateral toes raised, small. Ears long, nearly of the length of head, or longer than head.

Sp. *Scirtetes jaculus* WAGN., *Dipus jaculus* PALL., *Mus jaculus* PALL. (not L.) *Glir.* Tab. 20 (copied in SCHREB. Tab. 228); in the steppes between the Donau and the Don and in the Crimea, the *Alak-daagha* of the Mongols. Here also belong various other species from the steppes on the East coast of the Caspian Sea and at the Sea of Aral, as also a species from North America, *Alactaga arundinis* F. CUV. (The molars of this genus, more

complex than those of *Dipus*, are figured by F. CUVIER *Des dents des Mammif.* No. 76, p. 189.)

Jaculus WAGLER, WAGN., *Meriones* F. CUV. (not ILLIG.). Upper incisors indented by a longitudinal groove. Molar teeth $\frac{4-4}{3-3}$, furnished with roots, the first upper small, the rest with crown figured by undulant folds of enamel. Ears rounded, with short hair. Fore feet with four toes and hallucar wart with flat nail; hind feet pentadactylous, with three middle toes long, strong. Tail very long, somewhat naked.

Sp. *Jaculus labradorius* WAGN., *Gerbillus labradorius* HARLAN (*Faun. Americ.* p. 157), *Meriones labradorius* RICHARDSON, *Fauna bor. Am.* Pl. 7, p. 144; in the Northern regions of North America; a small animal of the length of about 10 inches, of which the tail forms more than one-half; red-brown, darker brown on the back, on the sides and below white.

Note.—Genus *Dipodomys* GRAY, furnished with buccal pouches, is unknown to me. Sp. *D. Philippii* from Mexico. See *Ann. of nat. Hist.* VII. 1841, pp. 521, 522;—*Dipodomys agilis* GAMBEL from California, *ib.* Sec. Series, Vol. III. 1849, p. 318.

Family XXXI. *Sciurina.* Incisor teeth smooth, compressed, molars mostly $\frac{5-5}{4-4}$ $\left(\text{sometimes } \frac{4-4}{4-4} \text{ or } \frac{4-4}{3-3}\right)$, enamelled continuously or complex, furnished with roots. Feet either all pentadactylous, or fore feet with four toes and thumb-wart. Tail hairy. Clavicles perfect.

Phalanx I. *Myoxina.*

Myoxus ZIMMERMANN, BODD., GM. Molar teeth $\frac{4-4}{4-4}$, with rows in each jaw parallel, remote, the crown with transverse striæ narrow, approximate. Ears moderate, rounded and oval, with short hair. Whiskers long. Fore feet with four toes and hallucar wart, clawless, hind feet pentadactylous; claws small, compressed, incurved, sub-erect. Tail long, densely clothed with long hair, in some sub-distichous.

Sp. *Myoxus glis* SCHREB., *Sciurus Glis* L., BUFF. VIII. Pl. 24, SCHREB. *Säugth.* Tab. 225, GUÉR. *Iconogr., Mammif.* Pl. 24, fig. 2; *le loir, der Siebenschläfer;* pale ash-coloured, white below, a dark brown ring round the eyes, size of a rat; this species is the *glis* of the ancients, which they

highly prized as a dainty, and used to fatten in separate hutches; it lives in the South of Europe up to the Wolga, also in Georgia.—*Myoxus nitela* SCHREB., *Mus quercinus* L., BUFF. VIII. Pl. 25, SCHREB. *Säugth.* Tab. 226. —*Myoxus avellanarius*, *Mus avellanarius* L., *Myoxus muscardinus* BUFF. VIII. Pl. 26; the smallest European species, ruddy yellow. A still smaller, with short ears, and dark brown longitudinal streak on the back, occurs in Japan, *Myoxus elegans* TEMM.

These animals live in trees and feed chiefly on nuts, small birds, eggs and beetles[1]; they sleep during the winter. In external form they have some resemblance to the squirrel (especially the species first named). The skull, however, between the orbits is much narrower. They have no cœcum, in which respect they deviate from all other rodents. From a species from the Cape of Good Hope, which (probably only in aged individuals with worn teeth) has simple molars without transverse bands, F. CUVIER formed the genus *Graphiurus*. The crowns of the molars present indeed in the other species of this genus very great variety; see CUVIER *Rech. sur les Ossem. foss.* III. p. 299, Pl. 68, figs. 8—11, where they are described and figured in the three European species cited by us.

Phalanx II. *Arctomyina.*

Arctomys SCHREB., GM. Incisor teeth smooth in front, rounded, molars $\frac{5-5}{4-4}$, enamelled continuously, marked by transverse tubercles on the crown, the first upper tooth less than the rest. Ears short, rounded, scarcely emergent from the fur of head. Fore feet with four toes and hallucar wart unguiculate, hind feet pentadactylous; claws incurved, strong. Tail short, in a few moderate, equalling or slightly surpassing half the length of body. (Dent. form. OWEN, i. $\frac{1-1}{1-1}$, p. $\frac{1-1}{1-1}$, m. $\frac{4-4}{3-3}=22$.)

Compare F. CUVIER *Considérations sur les caractères génér. de certaines familles de Mammif., appliqués aux Marmottes et formation du genre Spermophile, Mém. du Mus.* IX. 1822, pp. 293—305, Pl. 15, 16; on the North American species, J. SABINE *Transact. of the Linn. Soc.* XIII. 1822, pp. 579—591.

Arctomys F. CUV. Buccal pouches none. Tail short, furnished with long hair from its origin.

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[1] Sometimes they attack small animals also. Thus F. S. LEUCKART states that a *Myoxus nitela* eat up some bats, with which it had been shut up for the winter (HEUSINGER *Zeitschr. f. die organ. Physik*, III. Heft 4, s. 480); the Count TYZENHAUS states, that a *Myoxus dryas* in confinement eat up its two newly-born young ones (GUÉRIN *Revue et Magas. de Zoologie*, 1850, p. 363).

Sp. *Arctomys marmota* SCHREB., *Mus marmota* L., BUFF. VIII. Pl. 28, SCHREB. *Säugth.* Tab. 207, CUV. *R. Ani., éd. ill., Mammif.* Pl. 55, fig. 1; the skeleton figured in PANDER *u.* D'ALTON *Vergl. Osteol.* Heft V. Tab. 6: the *marmot;* 1½ feet long, tail 6″; greyish-yellow, top of the head dark grey, tail at the base russet, at the tip brown, incisors yellow; lives near the snow-line on high mountains of Europe; they pass the winter in their holes asleep. Compare on this animal GESNER *Quadrup.* p. 743, SCOPOLI *Ann. hist. nat.* II. 1769, pp. 37, 38.—*Arctomys bobac, Mus bobac* PALL. *Glir.* Tab. 5; in Poland, Russia and the North of Asia. The remaining species are from North America, as *Arctomys monax* GM. (from which *Arct. empetra* and *pruinosus*, according to the Prince of NEUWIED, do not differ), SCHREB. *Säugth.* Tab. 210, GUÉR. *Iconogr., Mammif.* Pl. 24, fig. 1.

Spermophilus F. CUV. Buccal pouches. Tail short or moderate, with hair at the base and upper part of the sides close, short, at the point and sides longer. (Species smaller and more slender.)

Sp. *Arctomys citellus* GM., *Mus Citellus* L., PALL. *Glir.* Tab. 6, SCHREB. *Säugth.* Tab. 211 A; in Bohemia, Austria, Hungary and Siberia;—*Arctomys Hoodii* SABINE, *Sciurus tredecimlineatus* MITCHILL, RICHARDSON *Faun. bor. Am.* I. Pl. 14; a prettily marked species from North America, brown above with yellow longitudinal stripes, alternating with rows of round yellow spots; grey below, &c.

This sub-genus, more numerous in species than the preceding, forms the transition from the marmots to the squirrels. The marmots and squirrels have much resemblance in their skull; the frontal bone is furnished with a process descending behind the orbits. The skull of the marmots is, however, flatter and less broad between the orbits than in the squirrels.

Phalanx III. *Sciurina* (in stricter sense).

Anomalurus WATERH. Molar teeth $\frac{4-4}{4-4}$, complex, with crown quadrate, the lower grooved on the inside. Ears triangular and oval, somewhat naked. Fore feet with four toes and hallucar wart, hind feet pentadactylous. Claws compressed, incurved. Hairy skin expanded between the humerus and the hind feet, produced from the soles to the thighs, and joining the tail at its base with the thighs. Tail longer than half the body, clothed with rigid hair, longer at the extremity, and covered below at the base with a double row of horny scales alternate, imbricate.

Sp. *Anomalurus Fraseri* WATERHOUSE, *Proceed. of the Zool. Soc.* 1842, pp. 125—127;—*Anomalurus Pelii* TEMM. *Esq. Zool. sur la côte de Guiné*, p. 146; black, grey below, head above the nose and the posterior margin of the parachute pure white, tail long and pale russet;—*Anomal. laniger*

TEMM. These species from the West coast of tropical Africa deviate from all the *Sciurina* in the absence of the post-orbital process of the frontal bone, in the large infra-orbital foramen and in the large number of ribs (15 pairs, whilst the rest of the *Sciurina* have only 12, except very few which have 13). The skull has a convex surface above the orbits, as in *Arctomys*. A cartilaginous, falciform ligament for the support of the parachute passes off from the ulnar process. P. GERVAIS' *Description osteol. de l'Anomalurus et remarques sur la classification naturelle des Rongeurs, Ann. des Sc. nat.*, 3me Série, XX. 1853, pp. 238—246, Pl. 13, fig. 1—7.

Pteromys CUV., GEOFFR., ILLIG. Molar teeth $\frac{5-5}{4-4}$, the first upper very small, placed at the inside of the second. Feet as in the preceding genus. Hairy skin at the sides of body produced between the fore and hind feet, rising from the carpus; fibro-cartilaginous falciform support inserted in the carpus at the outside. Tail covered with hair below and above. (Dent. form. OWEN, i. $\frac{1-1}{1-1}$, p. $\frac{2-2}{1-1}$, m. $\frac{3-3}{3-3} = 22$.)

Pteromys (in stricter sense). Molar teeth complex. Tail rounded, densely haired, of the length of body or longer than body.

Sp. *Pteromys petaurista, Sciurus petaurista* PALL. *Misc. Zool.* Tab. VI. VOSMAER *Beschrijving van den grooten Oost-Indischen vliegenden eekhoorn*, Amsterdam, 1767, 4to (with col. fig.);—*Pteromys nitidus*, &c. (In this and the following sub-genus the infra-orbital foramen is very small.)

Sciuropterus F. CUV. Molar teeth tuberculate. Tail shorter than body, flat, distichous.

Sp. *Pteromys vulgaris* WAGN., *Sciurus volans* L. (excl. syn. CATESB.), SCHREB. *Säugth.* Tab. 223, BLUMENB. *Abbild. nat. Gegenst.* No. 71; in the North-east of Europe and Siberia;—*Pteromys volucella, Sciurus volucella* GM., BUFF. X. Pl. 21, GUÉRIN *Iconogr., Mammif.* Pl. 23, fig. 3, *Dict. univ. d'Hist. nat., Mammif.* Pl. 9 A; North America, &c.

Sciurus L. (excl. some spec.). Incisor teeth smooth in front, brown or orange-coloured, the lower compressed, acute; molars $\frac{5-5}{4-4}$, tuberculate, marked by exsert transverse striæ, enamelled continuously, with first small and placed at the inside of second. Fore feet tetradactylous with hallucar wart unguiculate. Claws compressed, incurved. Skin not expanded at the sides of body.

Tail of various length, always longer than half the body. (Dental formula as in the preceding genus.)

Compare on the subdivisions of this genus F. CUVIER *Mém. du Mus.* x. pp. 116—128, Pl. x.

Tamias ILLIG., F. CUVIER. Buccal pouches.

Sp. *Sciurus striatus* L. (in part), PALL. *Glir.* p. 378, Siberia, also Japan;—*Sciurus Lysteri* RICHARDS. *Faun. bor. Am.* I. Pl. 15, p. 181 (fig. cop. in CUV. *R. Ani., éd. ill., Mamm.* Pl. 53, fig. 2); North America (LINNÆUS included both species under the name of *Sc. striatus*). The mode of life of this species agrees, according to RICHARDSON, with that of the Siberian. These animals live in holes under ground and do not make their nest in trees, like the common squirrels, which have no buccal pouches. They have the tail shorter than the body, shorter feet than the rest of the squirrels, and in some degree the *habitus* of *Spermophilus*.

Sciurus (in stricter sense). Buccal pouches none.

α) *With hair rigid, setose, and ears short* (*Xerus* EHRENB.). Sp. *Sciurus setosus* FORSTER, *Sciurus Levaillantii* KUHL. (A large species from South Africa, above pale ruddy-brown, below grey, tail variegated, brown and white, feet pale coloured, a white longitudinal streak on each side. All the species of this subdivision hitherto known are from Africa.)

β) *With hair soft.* Sp. *Sciurus vulgaris* L., BUFF. VII. Pl. 32, SCHREB. *Säugth.* Tab. 212; the *squirrel, l'écureuil, das Eichhörnchen;* commonly reddish, chestnut-brown on the back, belly white, a tuft of hair on the ears, the hair on the long tail directed to the two sides. This species lives in trees in Europe and the North of Asia; in the North it becomes grey in winter (see a fig. in CUV. *R. Ani., éd. ill., Mammif.* Pl. 53, fig. 1); it supplies in this state a fur known by the name of *petit gris.* Many species are found of this genus (the most numerous of the whole order) in Africa, Asia and America. Amongst the Eastern species we notice *Sciurus maximus* SCHREB., (*Sciurus macrourus* ERXL.), SCHREB. *Säugth.* Tab. 217, *Dict. univ. d'Hist. nat., Mammif.* Pl. 9, fig. 1, and *Sciurus exilis* S. MUELLER, *Natuurkundige Verhandelingen over de Nederlandsche Bezittingen, Mammalia,* Pl. 15, fig. 4, as the two extremes as to size (the last from Borneo not larger than a mouse).—*Sciurus laticaudatus* S. MUELLER, *ib.* fig. 1, a species from the same island, differs remarkably from the rest of the squirrel-species by its long and very narrow skull; the sub-genus *Tamias* (see above) resembles it to a certain degree in its skull.

The sub-genus *Macroxus* F. CUV. is distinguished by a narrow and more cylindrical tail and a large *scrotum.* Sp. *Sciurus æstuans* L., BUFF. VII. Pl. 65, MAXIM. *Abb. zur Naturgesch. Brasiliens.* Liefer. III.

Chiromys CUV., GEOFFR., ILLIG. Incisor teeth compressed, acuminate; molars $\frac{4-4}{3-3}$, enamelled continuously, tuberculate, flat,

the crown being worn. Feet pentadactylous, the anterior with toes long, the middle toe very long, slender; hind feet with hallux raised, nail flat, broad. Tail elongate, villous.

Sp. *Chiromys madagascariensis* DESM., *Sciurus madagascariensis* GM., SONNER. *Voy. aux Ind. Or.* (2e éd. Paris, 1806, Pl. 92, Tom. IV. p. 121), SCHREB. *Säugth.* Tab. 38 D (fig. SONNER.), GUÉR. *Iconogr., Mammif.* Pl. 26, fig. 4; the skull fig. in CUVIER *R. Ani.* 1817, Pl. 2, figs. 1—3. This remarkable animal (*l'aye-aye* of the French zoologists) discovered by SONNERAT on the island of Madagascar, has the external form of Galago, a genus of the Lemurids, and forms (by its arched skull also) in some degree the transition from the rodents to the quadrumanes. It has large, naked ears, is sluggish and lives in holes, concealing itself there during the daytime. The few specimens which have been brought to Europe hitherto, are to be found, as far as I know, in the Museum of the *Jardin des Plantes* at Paris exclusively. LIÉNARD has given a note on a living specimen of four months, *Comptes rendus de l'Acad. des Sciences*, 1855, XLI., GUÉRIN *Revue de Zool.* VII. p. 436. An adult animal was described by VINSON, GUÉR. *Revue*, l. l. p. 478.

ORDER VIII. *Feræ.*

Incisor, canine and molar teeth, or in place of canines false molars, conical; molar teeth equably enamelled, tuberculate or cuspidate. Feet unguiculate, with claws compressed, acute, uncinate; pollex not separate from the other toes.

Carnivorous animals. The most live on animal food, some exclusively; a few eat fruits also, and other vegetable matters. Their motions are rapid; their irritability great; many have uncommon muscular power. Their organs of sight and smell are peculiarly developed. On the movements of the lower jaw and the disposition of its articulation, see above, p. 576.

SECTION I. *Pinnipedia.*

Family XXXII. *Pinnipedia* ILLIG. Upper incisors four or six, lower four, two, or having served for a short time all, deciduous; molars with crown either flat, somewhat depressed or cuspidate, acute. Feet short, palmate, pentadactylous, the posterior turned backwards, approximate to each other. Toes of fore feet often decreasing in size from the pollex, lateral toes of hind feet longer than

the three middle toes. Body elongate, clothed with appressed hair, smooth, attenuate backwards, terminated by a very short, conical tail.

Phalanx I. Upper canine teeth large, exsert, destitute of root.

Trichechus L. (excl. of *Trichechus Manatus*). Incisor teeth deciduous, except an upper one on each side, resembling a molar; molars with crown flat, depressed, oblique. Muzzle covered, tumid forwards. Ears none. Four ventral mammæ.

Sp. *Trichechus Rosmarus* L., F. MARTENS *Spitzbergische Reisebeschr.* Hamburg, 1675, 4to; pp. 78—83, Tab. P, fig. *b*, COOK'S *Voyages*, &c. Atlas fol. Pl. 52, BLUMENB. *Abb. naturh. Gegenst.* No. 15[1], CUV. *R. Ani., éd. ill., Mammif.* Pl. 45; the skeleton is figured in PANDER *und* D'ALTON *Die Skelete der Robben u. Lamentine* (*Vergl. Osteologie*, Liefer. IX.) Tab. I. Comp. K. E. VON BAER *Anatomische u. zoologische Untersuchungen über das Walross* (*Trichechus rosmarus*) *und Vergleichung dieses Thiers mit andern See-Säugthiere, Mém. de l'Acad. Impér. des Sc. de St Petersbourg, VIième Série, Sc. math. physiques et naturelles*, Tom. IV. 1838, pp. 95—235. The *Walrus* (*le morse,—mors* or *morsz* is a Russian word for this animal). It is from 10 to 12 feet long; it is said that it sometimes attains a length of 20 feet. The walruses live together in troops in the sea towards the North Pole, especially at Spitzbergen and Nova Zembla and in Behring's Straits; they sleep on the drifts of ice, whilst some keep guard, and when danger threatens awake the others by bellowing. The mothers defend their young and carry them off when wounded.

We have not given the number of teeth on account of the great difference to which it is subject from the period of life. Comp. H. KERSTEN *Capitis Trichechi Rosmari descriptio osteologica.* Cum Tab. 2, Berolini, 1821, (from the investigations of RUDOLPHI), WIEGMANN *Ueber das Gebiss des Walrosses, Archiv f. Naturgesch.* 1838, s. 390—413. G. JAEGER *ibid.* 1844, s. 70—75. According to RAPP and WIEGMANN there are originally $\frac{6}{6}$ incisors, $\frac{1-1}{1-1}$ canines, $\frac{5-5}{4-4}$ molars, but the posterior molar and all the incisors soon fall out; the tooth which is usually regarded as the first molar is, according to RAPP, the lower canine. The large superior canines, which are 15 or more inches long, and of which each weighs sometimes 10 pounds, are in some individuals with the points bent

[1] This figure of BLUMENBACH is a copy after the same original from which that of DE LAET *Novus Orbis*, L. B. 1663, p. 38, was also taken, viz. a specimen brought alive to Holland in 1612, and which was described by A. E. VORSTIUS, Professor at Leyden.

towards each other, in others turned outwards. Prof. N. C. De Fremery was of opinion, that on this and other accounts two species should be adopted. Sundevall, however, justly observes that scarcely two skulls can be examined in which no minute differences in the direction and size of the tusks can be observed; *Aorsberœttelser för* 1837—1840, p. 111. See also Stannius *Ueber Gebiss und Schädel des Walross u. s. w.* Mueller's *Archiv f. Anat. u. Physiol.* 1842, s. 390—413.

Phalanx II. (*Phocina*). Incisor teeth persistent, upper canines included, molars $\frac{5-5}{5-5}$ or $\frac{6-6}{5-5}$. Ears none or small. Two or four mammæ, ventral, placed near the umbilicus.

The *seals* (the genus *Phoca* L.) live in various seas, and also occur, at least in part, at the mouths of rivers; they are especially numerous in the polar regions, and are wanting in the tropical parts of the ocean. The structure of the body is adapted exclusively for rapid and sustained swimming. The seals creep upon the shore, and then bend their spine in direct curves up and down, which motions have been compared with those of the surveyor caterpillars. They delight in lying on the shore and on rocks in the sea to sun themselves. They live upon molluscs, crustaceans, &c., but principally upon fish. Their note is a bark, not so strong as that of dogs, and which they make heard at evening time especially, and on approaching change of weather. Their body is covered with harsh hair that lies close to the body; the skin secretes a fatty matter by which the hair is rendered more glossy, and the body more effectually protected from the water; below the skin a thick layer of fat is disposed over the whole body, whilst on the other hand fat is almost entirely absent in the inward parts. We have already remarked above upon some peculiarities of their internal structure; amongst which is the length of the intestinal canal (p. 582), the large sinus of the *vena cava* (p. 586), &c. They have no clavicles, a very small humerus and femur, fifteen ribs, five lumbar vertebræ. The brain is very large. The organ of smell appears to be peculiarly developed, whilst the inferior turbinated bones have many plates, and afford a large surface for the mucous membrane. The tongue is rough and bifid at the extremity. Long whiskers, attached to the lips, conduct the impressions of touch to branches of the fifth pair. These hairs are thick and flat, and have in most of the species sinuous margins, which give them the appearance of being knotted or jointed. (See Albini *Annot. Acad.* III. Tab. VI,

fig. 6[1].) The intellectual faculties of the seals appear to be very considerable, and they possess much docility[2]. What has been said refers principally to the common species, *Phoca vitulina*, which has been most observed and investigated.

Compare BLAINVILLE *Sur quelques crânes de Phoques, Journal de Physique*, 1820, Octobre, Tome XC. pp. 286 et suiv.; W. VROLIK *Specimen anatomico-zoologicum de Phocis, speciatim de Phoca vitulina*, Traj. ad Rhen. 1822, 8vo, c. Tab.; DUVERNOY *Rech. anat. sur les organes du mouvement du Phoque commun, Mém. du Mus.* IX. 1822, pp. 49—79, pp. 165—169; F. CUVIER *De quelques espèces de Phoques et des groupes génériques entre lesquels elles se partagent, Mém. du Mus.* XI. 1824, pp. 174—214, Pl. 12, 15; ROSENTHAL *Ueber die Sinnesorgane der Seehunde, Nov. Act. Acad. Leop. Car.* XII. 2, 1825, s. 673—694, ejusd. *Zur Anatomie der Seehunde, ibid.* XV. 2, 1831, s. 313—348, Tab. 75—77, E. H. WEBER *Einige Bemerkungen üb. d. Bau des Seehundes, Berichte üb. die Verhandl. der Kön. Sächs. Gesellsch. d. Wiss., Math. Phys. Kl.* 1850, s. 108—129, &c.

For a description of the northern species may be consulted: G. FABRICIUS *Udförlig Beskrivelse over de Grönlandske Skæle; Skrivter af naturh. Selskabet.* Kjöbenhavn, I. 1790, pp. 79—157, I. 2, 1791, pp. 73—170; THIENEMANN *u.* GUENTHER *Reise im Norden Europa's, vorzüglich in Island*, Ie Abth. Leipzig, 1823, 8vo, (with col. figures); and especially S. NILSSON *Skandinavisk Fauna*, I. 2 Uppl. Lund, 1847, 8vo, pp. 274—317. The same savant also gave in the Transactions of the Academy of Stockholm for 1837 a review of the whole family, of which a German translation may be found in *Arch. fur Naturgesch.* 1841, p. 301.

The genus *Phoca* of LINNÆUS has by modern zoologists been divided into various genera. For this end PÉRON employed the absence or the presence of external ears; BLAINVILLE borrowed his characters from the number of the incisor teeth; F. CUVIER from the form of the skull and from the disposition of the molars.

† *External ears none.*

Cystophora NILSS. (*Macrorhinus* F. CUV.), *Stemmatops* F. CUV.[3] Incisor teeth $\frac{4}{2}$, conic; canines thick, large, molars $\frac{5-5}{5-5}$, with

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[1] In no individual, however, of the *Otariæ* investigated by me have the whiskers, which are very thick and horny in that genus, these sinuous margins.

[2] PLINII *Hist. Nat.* Lib. IX. c. 13. Compare F. CUVIER *Observations zoologiques sur les facultés physiques et intellectuelles du Phoque commun, Ann. du Mus.* XVII. pp. 377—397.

[3] "*Qui signifie front couronné*," *Mém. du Mus.* XI. p. 200, *Dict. des Sc. Nat.* XXXIX. p. 550. Consequently the author wrote incorrectly *Stemmatopus*, from which again the unmeaning etymology of AGASSIZ was derived; *Nomenclator Mammal.* p. 32. The name is an imitation of that of *Phoca mitrata*.

simple root, distinct, small, conic or compressed at the apex, rugose or striate. Nose of males furnished with expansile appendage. (Dent. form. OWEN, i. $\frac{2-2}{1-1}$, c. $\frac{1-1}{1-1}$, p. $\frac{3-3}{3-3}$, m. $\frac{2-2}{2-2} = 30$.)

Sp. *Cystophora proboscidea* NILSS., *Phoca leonina* L. (not O. FABR.), *Phoca proboscidea* PÉRON, SCHREB. *Säugth.* Tab. 83, (fig. from ANSON'S *Voyage*), PÉRON *Voyage, Atl.* Pl. 32; F. CUV. *Mém. du Mus.* XI. Pl. 14, (figures of cranium[1]), *Des Dents des Mammif.* pp. 123, 124, Pl. 39 A, OWEN *Odont.* p. 510, Pl. 132, 137; the largest species, it attains a length of 20 to 25 feet; it lives in the southern hemisphere, is much hunted for the oil, and great numbers are killed annually.—*Cystophora borealis* NILSSON, *Phoca cristata* ERXL., FABR., *Phoca leonina* O. FABR. previously, H. EGEDE *Grönlands nye Perlustration*, Kjöbenhavn, 1741, Tab. at p. 46, *Klapmüts* (Dutch Trans., Delft, 1746, p. 69), FABR. *Skr. af nat. Selskab.* I. 2, pp. 120—139, Tab. 12, fig. 2 (cranium), F. CUV. *Mém. du Mus.* l. l. Pl. 13, figs. *g, h, i, Dents des Mammif.* Pl. 38 B; (the two lower canines have fallen out in some skulls). This species occurs chiefly in Greenland, and becomes 7 or 8 feet long. The space between the external nostrils and the apertures in the bony head is occupied in adult males by a membranous and muscular sac divided into two lateral chambers by a prolongation of the septum of the nose; when the nostrils are closed the seal can inflate these spaces in a remarkable manner: see W. RAPP in MECKEL'S *Archiv f. Anat. u. Physiol.* 1829, s. 236—241, Tab. 7.

Leptonyx GRAY, WAGN. Incisor teeth $\frac{4}{4}$, cuspidate, the lower small, molars $\frac{5-5}{5-5}$, the hinder furnished with a double root. Claws, especially of hind feet, small.

Stenorhynchus F. CUV. Molars compressed, with the edge of crown divided by three or four lobes. Cranium narrow, elongate.

Sp. *Leptonyx leopardinus* WAGN., *Phoca leptonyx* BLAINV., *Stenorhynchus leptonyx* F. CUV. *Dict. des Sc. nat., Mammif.* Pl. 47, fig. 1, *Mém. du Mus.* l. l. Pl. 13, figs. *a, b, c, des Dents des Mammif.* Pl. 38 A;—*Stenorh. serridens* OWEN, *Ann. and Mag. of nat. Hist.* XII. 1843, p. 332, *Phoca carcinophaga*, D'URVILLE *Voy. au pôle sud*, &c. The known species of this division are all from the southern hemisphere. Comp. GRAY *Voy. of the Erebus.*

Pelagius F. CUV. Molars with base oblique, somewhat broad, oblong, compressed towards the crown, with middle cusp conical.

Sp. *Leptonyx monachus* WAGN., *Phoca monachus* (HERMANN *Beschäftigungen der Berliner Gesellschaft naturf. Freunde*, IV. s. 456, Tab. 12, 13), *Phoca*

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[1] Fig. 2 (*d, e, f*), there named *Phoque des Patagons*, belongs to a younger individual of the same species.

albiventer BODD., BUFF. *Suppl.* IV. Pl. 44, *Encycl. méthod., Mamm.* Pl. 110, fig. 1, *Dict. des Sc. natur., Mamm.* Pl. 47, fig. 2; this species occurs in the Mediterranean Sea, and seems to have been that most known to the ancients. It may attain a length of more than 10 feet. Compare on this species the observations of F. CUVIER *Ann. du Mus.* XX. pp. 387—392.

Phoca L. (in part), *Callocephalus* F. CUV. Incisor teeth $\frac{6}{4}$, molars $\frac{5-5}{5-5}$, with crown compressed, the cutting edge usually with three or four triangular cusps; (three premolars).

Comp. F. CUV. *Mém. du Mus.* l. l. Pl. 12; *des Dents des Mamm.* pp. 118, 119, Pl. 38.

a) *With three or four anterior molars with simple root (the crown scarcely tricuspidate or undivided). Halichœrus* NILSSON.

Sp. *Phoca gryphus* FABR. l. l. 1. 2, s. 167, Tab. 13, fig. 4; NILSS. *Illum. Fig. till Skand. Fauna,* XX Häft, Pl. 34, figs. 1, 2; *de kromneuzige zeehond,* the *grey seal;* a large greyish species, which occurs chiefly in the Baltic and also in the North Sea to the coast of Iceland, the *Utselur* of the Icelanders, (comp. HALLGRIMSON in KROEJER'S *Tijdskrift,* II. pp. 91—99); there is often a sixth smaller molar in the upper jaw; REINHARDT *ibid.* IV. pp. 313, 314.

b) *With all the molar teeth, except the first, furnished with double roots.*

Sp. *Phoca vitulina* L., SCHREB. *Säugth.* Tab. 84, *Dict. des Sc. nat., Mamm.* Pl. 46, CUV. *R. Ani., éd. ill., Mamm.* Pl. 44, fig. 1; the *common seal, le phoque commun, veau-marin, der Seehund;* from 4 to 6 feet long. In this and other species of this division the space between the large orbits at the upper part of the skull is very small. By the bony head arched in front like that of a sheep and the greater distance between the orbits is distinguished *Phoca barbata* MUELL., which sometimes in extreme old age loses all its teeth or retains only a pair of molars in the upper jaw. The skull of this large Norwegian species is figured in FABRICIUS lib. cit. Pl. 13, fig. 3, F. CUV. *Mém. du Mus.* l. l. Pl. 12, figs. *k, l, m.* (In this species the second and third toes of the fore feet are the longest.)

†† *External ears short.*

Otaria PÉRON. (*Arctocephalus, Platyrhynchus* F. CUV.). Incisor teeth $\frac{6}{4}$, the four upper and middle with crown broad, divided by a transverse groove, the two outer conic; molar teeth with root simple $\frac{6-6}{5-5}$, more rarely $\frac{5-5}{5-5}$, premolars $\frac{3-3}{3-3}$. Fore feet

remote, with first toe longest of all. Membrane of hind feet produced into strips beyond the toes. Three middle and hinder toes sub-equal, little shorter than the lateral toes.

Sp. *Otaria ursina* DESMAR., *Phoca ursina* L., BUFF. *Suppl.* VI. Pl. 47, SCHREB. *Säugth.* Pl. 82; with brown, woolly hair; the young animal is black, (*Phoca pusilla* SCHREB., BUFF. XIII. Pl. 53);—*Otaria jubata* DESM., *Phoca jubata* SCHREB., GM. (in part), BUFF. *Suppl.* VI. Pl. 48, SCHREB. *Säugth.* Tab. 83 B;—*Otaria Stelleri* LESS., SCHLEG. *Fauna Jap., Mamm.* Pl. 21—23, &c.

Compare the figures of the skull in F. CUVIER *Mém. du Mus.* XI. Pl. 15, of the teeth in the work *Des Dents des Mamm.* Pl. 39, and OWEN *Odont.* Pl. 132, fig. 6.

SECTION II. *Carnivora.*

Incisor teeth $\frac{6}{6}$, canines large, acuminate; molars uniformly enamelled, with acute crown uneven, one or more of the hinder teeth tuberculate. Toes mostly cloven.

To this division belong the species which, more than the rest of the *ferœ*, deserve the name of *carnivores* or beasts of prey. Although some (*Lutra*) have swimming membrane between the toes, all are formed for running, a kind of movement for which the animals of the preceding division are not adapted.

One of the molar teeth, which exceeds the rest in size, is furnished with a sharp cutting edge (*dens lacerans, dens sectorius, la carnassière* F. CUVIER); the smaller molars placed in front of these are named *false molars* (*fausses molaires*), whilst the hindmost molars that have flat crowns are named *tuberculate* molar teeth; see F. CUVIER in the *Ann. du Mus.* x. pp. 104—129, and in his work, so frequently referred to, on the teeth of mammals. OWEN has given a different division of the teeth, which is more physiological. He, as has already been stated, distinguishes the molar teeth as *premolars* and *true molars;* the first are successional, the last not. The typical number of the premolars is 4 in both jaws on each side, that of the true molars 3. In the genus *Felis* the premolars are 3 above and 2 below, with only one true molar above and below: namely the small tuberculate molar of the upper jaw, and the *laniary* or *carnassial* molar of the lower jaw. See *Ann. des Sc. nat.*, 3e Série, III. 1845, *Zool.* p. 116—128, and TODD'S *Cyclop.* IV. pp. 898—935.

Family XXXIII. *Felina.* Molar teeth $\frac{4-4}{3-3}$, two false molars on each side in both jaws; a single tuberculate tooth on each side in upper jaw only, small, transverse. Digitigrade, with soles hairy. (Dental formula OWEN, i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{3-3}{2-2}$, m. $\frac{1-1}{1-1} = 30$.)

The *digitigrades* are those carnivores which run, like the dog, the cat, &c., on the digits only and not on the hand and the foot (*carpus* and *tarsus*), in contradistinction to the *plantigrades*, as the bears. Of the digitigrades the feline genus forms a distinct family. No genus of carnivores has a smaller number of molar teeth; hence they have short jaws also. The head has a round contracted form. With the exception of New Holland, they are met with in almost every part of the world. The largest species live in warmer countries.

Felis L. (Characters of the family. Fore feet pentadactylous, hind feet tetradactylous. Claws retractile, in a few semi-retractile.)

Compare on this genus G. CUVIER *Espèces vivantes de grands chats, Ann. du Mus.* XIV. pp. 136—164, (with figures of the skulls; also multiplied in his *Rech. sur les Ossem. foss.* IV. pp. 408—448); TEMMINCK *Monogr. des Mamm.* I. pp. 73—156. LINNÆUS (in the twelfth edition of his *Syst. nat.*) counted only 7 species of this genus, the number of those now known is almost seven times greater.

Sp. *Felis Leo* L., BUFF. IX. Pl. 1, 2, SCHREB. *Säugth.* Tab. 97 A, B., LACEP. *Ménag. du Mus.* I. pp. 150—176 (fem.), CUV. *ibid.* pp. 298—310 (male), the skeleton in PANDER *und* D'ALTON *Die Skelete der Raubthiere,* Tab. I. the *lion;* single colour, yellowish-ruddy; the tail with a bundle of longer hair at the tip; in the male a mane along the neck, which begins to be formed in the third year, and in an Indian variety continues small, (SMEE *Account of the maneless Lion of Guzerat, Zool. Transact.* I. 2, pp. 165—174, Pl. 24).[1] The lioness bears her young about 3 months; the young come into the world with darker stripes on the back and round spots. To what age the lion may attain is unknown; it is said that some have lived for 60 or 70 years in confinement in England. In the time of Xerxes lions were still existing in Greece and attacked the camels of his army. (HERODOT.

[1] On a horny point at the end of the tail compare G. JAEGER in MECKEL'S *Archiv für Anat. u. Physiol.* VI. 1832, s. 55, and E. BÉKKER *Der Stachel des Löwen an dessen Schweif-ende,* Darmstadt, 1855, 8vo.

VII. 125, 126); at present this species is met with only in some parts of Western Asia and in most countries of nearly the whole of Africa. (In the diluvial period a feline species was living which had much resemblance to the lion, but was larger; its remains are met with in various caverns, *Felis spelæa* GOLDFUSS, *Nov. Act. Acad. Nat. Cur.* IX. p. 476, CUV. *Ossem. foss.* IV. p. 450, Pl. 36.)

Felis concolor L. (and *discolor* SCHREB.), GM., BUFF. IX. Pl. 19, SCHREB. *Säugth.* Tab. 104 B; the *Puma* or *Couguar*, ruddy-yellow, with inconspicuous, darker, round spots; the tail has not a tuft of hair at the extremity. This species, smaller than the lion or the tiger, is dispersed over a great part of America.

Felis Tigris L., BUFF. IX. Pl. 9, SCHREB. *Säugth.* Tab. 98, *Ménag. du Mus.* II. pp. 30—44, GUÉRIN *Iconogr., Mamm.* PI. 18, fig. 2; the *tiger;* in Southern and Eastern middle Asia, even in temperate regions between 45° and 55° N.L. (see EHRENBERG *Ann. des Sc. nat.* XXI. p. 387), from Java and Sumatra to the peninsular of Corea. (Hybrids between lions and tigers have been observed in menageries.)

Amongst the large spotted species the first to be recorded is the *Jaguar* of South America and the southern part of North America, *Felis onça* L., BUFF. IX. Tab. 12, AZARA *Voyages*, Pl. 9, F. CUV. *Mammif.* LIVT. 17, 29. —In Africa is found the *panther* (*Felis pardus* L., GM., and *Felis leopardus* GM.), *Felis leopardus* TEMM., *Ménag. du Mus.* I. p. 212, and on the Sunda islands a somewhat smaller species, with very long tail, *Felis variegata* WAGN., *Felis pardus* TEMM.

Amongst these spotted species we record also, on account of the claws only partially retractile[1], *Felis jubata* SCHREB. *Säugth.* Tab. 105, and *Felis guttata* HERMANN, SCHREB. Tab. 105 B., CUV. *R. Ani., éd. ill., Mamm.*, Pl. 42, fig. 2; two species, formerly confounded, of which the first occurs in India, the last in Senegal and Kordofán (see DUVERNOY *Mém. de la Soc. d'Hist. nat. de Strasbourg*, II. 1835). They form the sub-genus *Cynailurus* WAGLER.

To the smaller species belongs our *domestic cat*, of which there are many varieties. The anatomy of this species (osteology and myology) has been treated circumstantially by STRAUS-DURCKHEIM *Anatomie descriptive et comparative du Chat*, 2 Tomes, Paris, 1845, 4to, and Atlas in fol. It is supposed that this species is derived from a wild feline species of North Africa, *Felis maniculata* RUEPPELL, *Zool. Atl.* Tab. I., SCHREB. *Suppl.* Tab. 100 B, whilst that which occurs in the forests of Europe (chiefly in mountain regions in the Hartz, in the Carpathian mountains) and in some parts of Asia, *Felis catus* L., BUFF. VI. Pl. 1, SCHREB. Tab. 107 A, is larger and has a shorter tail; there are also some differences in the skull. See BLASIUS *Fauna Deutschl.* I. s. 162.

In some species the tail is very short and the ears with a pencil of hairs. To these belongs the *lynx* of the ancients, which, according to CUVIER, *Felis*

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[1] OWEN *On the Anatomy of the Cheetah, Felis jubata. Transact. of the Zool. Soc.* I. 2, 1834, pp. 129—138, Pl. 20.

caracal SCHREB., BUFF. XX. Tab. 24, is native of Africa and Persia. In the North of Europe occurs *Felis lynx* L., BUFF. IX. Tab. 21, of which *Felis cervaria* TEMM. and NILSS. and *Felis virgata* NILSS. are only varieties; NILSSON *Skandinavisk Fauna*, 2 Uppl. Lund, 1847, pp. 128, 129.

Family XXXIV. *Viverrina*. Molar teeth mostly $\frac{6-6}{6-6}$, three false on each side in upper jaw, three or four in lower. Only a single tuberculate tooth on each side in lower jaw or none, almost always two tuberculate teeth on each side in upper jaw. Feet mostly digitigrade, either pentadactylous or tetradactylous, with claws often semi-retractile. Glandular follicles between the anus and genitals, secreting a sebaceous matter of disagreeable odour. Tongue rough with rigid papillæ directed backward.

The *Civets*. The limits of this family cannot be sharply drawn, if we unite the genus *Hyæna* with it, and not with the preceding, which agrees indeed with *Felis* in the molar teeth, in the absence of a tuberculate molar in the lower jaw, but in other respects has little affinity with it. We are disposed however to prefer natural affinity to a strict and severe adherence to a single character, and with WATERHOUSE regard the Hyænas as a small divergent group of civet cats.

Hyæna BRISS., PENNANT, STORR. Molar teeth $\frac{5-5}{4-4}$, thick, false molars $\frac{3-3}{3-3}$, a single tuberculate tooth on each side in upper jaw, in lower jaw none. Feet all tetradactylous. Trunk short, declining backwarks from the shoulders. Tail short. (Dent. form. OWEN, i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{4-4}{3-3}$, m. $\frac{1-1}{1-1} = 34$).

Sp. *Hyæna striata* ZIMMERM., BODD., *Canis Hyæna* L., BUFF. *Suppl.* III. Pl. 46, SCHREB. Tab. 96, *Ménag. du Mus.* I. pp. 256—270; the *hyæna;* in North Africa, Asia Minor, Arabia and Persia. Compare on the anatomy DAUBENTON, BUFF. IX. pp. 280—298 and G. E. REIMANN *Spicilegium observationum anat. de hyæna*, Berolini, 1817;—*Hyæna crocuta* BODD., *Canis crocuta* ERXL., GM., SCHREB. *Säugth.* Tab. 96 B, CUV. *R. Ani., éd. ill., Mammif.* Pl. 40, fig. 1; in South Africa, at the coast of Guinea and in Senegal; this species in the neighbourhood of the Cape Colony is usually named *wolf;*—*Hyæna brunea* THUNB. (*Act. Holmiens.* 1820), *Hyæna villosa* SMITH, *Trans. of the Linn. Soc.* XV. 2, 1827, pp. 461—468, Pl. 19, GUÉR. *Iconogr., Mammif.* Pl. 18, fig. 1; the *strand-wolf* of the colonists in South Africa. This whole genus is peculiar to the eastern hemisphere. There are 15 or 16 dorsal vertebræ (15 or 16 pairs of ribs) and 4 or 5 lumbar vertebræ. The tibia and fibula are much shorter than

the bones of the fore-arm. The *hyænas* eat all kinds of offal and exhume corpses; ARISTOT. *Hist. Anim.* Lib. VI. c. 32, VIII. c. 5.

In caverns in the Hartz mountains, in Westphalia, in England (especially in the cave of Kirkdale in Yorkshire) fossil bones of a large species have been found, which has the most resemblance in the teeth to *Hyæna crocuta: Hyæna spelæa* GOLDFUSS; see CUVIER *Ann. du Mus.* XI. pp. 127—144, Pl. 42, and *Rech. sur les Ossem. foss.*, GOLDFUSS *Nov. Act. Acad. Cæs. Nat. Curios.* XI. pp. 456—462, Tab. 56, OWEN *Brit. foss. Mamm.* pp. 138—160.

Proteles ISID. GEOFFR. Molar teeth small, distant $\left(\frac{5-5}{5-5}\right.$ or frequently only $\left.\frac{4-4}{4-4}\right)$. Fore feet pentadactylous, with pollex raised, posterior tetradactylous, shorter. Back declining from the shoulders backwards. Tail very short, villous.

Sp. *Proteles Lalandii* ISID. GEOFFR., *Viverra hyænoides* DESMAR., GUÉRIN *Iconogr., Mamm.* Pl. 17, fig. 4, CUV. *R. Ani., éd. ill., Mamm.* Pl. 40, fig. 3; an animal from South Africa, of the bearing of a small striped *hyæna;* it lives in holes, which it digs, like the fox. The molar teeth differ much from those of the other carnivores; this difference was formerly ascribed incorrectly to the supposed fact, that the skull under observation belonged to a specimen not full grown. Compare on this remarkable animal ISID. GEOFFR. SAINT-HILAIRE *Mém. du Mus.* XI. 1824, pp. 354—371, Pl. 20, *Ann. des Sc. nat.*, Seconde Série, VIII. 1837, pp. 252—255; GUÉR. *Magas. de Zool.* 1841, *Mammif.* Pl. 31; SUNDEVALL in *Förhandlingar vid de Skandinaviske Naturforskarnes tredje Möte,* Stockholm, 1842, pp. 643, 644, (translated in OKEN'S *Isis,* 1845, s. 436). There are 15 ribs and 5 lumbar vertebræ; the bony palate is very broad and the underjaw low.

Viverra L. (excl. of some species). Molar teeth $\frac{6-6}{6-6}$, false molars $\frac{3-3}{4-4}$, tuberculate $\frac{2-2}{1-1}$. Feet pentadactylous, with claws small, incurved, pollex small, raised. (Dental formula OWEN, i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{4-4}{4-4}$, m. $\frac{2-2}{2-2}=40$.)

Comp. F. CUVIER *Des Dents des Mamm.* pp. 99—102, Pl. 34.—There are commonly 13 dorsal vertebræ and 7 lumbar vertebræ, the ordinary number in many carnivores, in the cat-tribe for instance, and the dogs. The trunk is elongated.

Sp. *Viverra Zibetha* L., BUFF. IX. Pl. 31, SCHREBER'S *Säugth.* Tab. 112, BRANDT *und* RATZEB. *Mediz. Zool.* Tab. I. fig. 1; light brownish-grey with brown spots; the throat whitish, with oblique dark stripes; tail shorter than body, short-haired, with black and light-brown rings; in the East Indies.—*Viverra civetta* SCHREB., BUFF. l. l. Pl. 34, *Ménag. du Mus.* I. pp. 218—234, BRANDT *u.* RATZEB. l. l. fig. 2, GUÉRIN *Iconogr., Mamm.*

Pl. 16, Cuv. *R. Ani., éd. ill., Mamm.* Pl. 38, fig. 1; the skeleton is figured in Pander u. D'Alton *die Skelete der Räubth.* Tab. IV.; larger than the preceding, light brownish-grey, with larger black spots; the tail short, long-haired, with some whitish spots, at the tip all black; on the back long hairs (mane); in Africa, at the coast of Guinea and in Mosambique. Both species bear the name of *civet cat*, and from both is obtained the fat substance known in perfumery and medicine under the name of *civet* (*zibetha, zibethium, civetta*); it is semi-fluid, smelling strongly of musk. The negroes seek this substance in trees on which the civet cats have voided it by rubbing. It is contained in two sacs, with an elongate, common opening, which are formed by a continuation of the integument, and are surrounded by many small glands. Besides these there are two other blind sacs, each of which has a separate small aperture on each side of the *anus*. These animals climb on trees, hunt for birds, and also feed on roots and fruits.—*Viverra Genetta* L., Buff. IX. Pl. 36, Guér. *Iconogr., Mammif.* Pl. 16, fig. 3, *Ménag. du Mus.* II. pp. 207—217; smaller than the *Viverra zibetha*, which in other respects it resembles; the tail is longer (little shorter than the body), with long hair, with black and white rings; in Africa and Spain. *Viverra indica* Geoffr., *Viverra rasse* Horsf. *Zool. Researches*, No. 6, Guérin *Magas. de Zool.* 1836, *Mammif.* Pl. 19; in the East Indies, &c.

By the body very slim and elongated, high legs, and long whiskers, is distinguished *Viverra gracilis* Desm., *Viverra linsang* Hardwicke, *Felis* (*Prionodon*) *gracilis* Horsf. l. l. No. 1.

A single species of *Viverra* is known from the new world (Mexico). It has longer hair, a small pointed head and large ears: *Viverra astuta, Bassaris astuta* Lichtenst. *Darstell. neuer Säugth.* Tab. 43, copied in Krauss *Thierreich*, I. Tab. II. fig. 3.

Herpestes Illig. Teeth as in the preceding genus. Ears small, short, rounded. Feet pentadactylous or tetradactylous, with claws compressed, incurved, large. Hair long, rigid, often ringed with distinct colours.

a) *With all the feet pentadactylous.*

Herpestes Ichneumon, Viverra Ichneumon L., *Herpestes Pharaonis* Desm., Buff. *Suppl.* III. Pl. 26, Schreb. *Säugth.* Tab. 115 B, Geoffr. St.-Hil. *Ménag. du Mus.* I. pp. 319—333; the *Ichneumon*, called *Nems* or *Nims* by the natives of Egypt; with the tail about 3′ long, hair yellowish-grey with darker rings, the tail with a tuft of black hair at the tip, legs blackish. This animal eats, besides eggs, especially of the crocodile, also snakes and other small animals, and is very shy.—*Herpestes pallidus* Wagn., *Viverra Ichneumon* β L., Schreb. *Säugth.* Tab. 116 *g*, Cuv. *R. Ani., éd. ill., Mamm.* Pl. 39, fig. 1, &c. A very numerous genus.

b) *With hind feet tetradactylous.*

Sub-genus. *Cynictis* Ogilby. (Legs tall. Ears rather larger than in *Herpestes.*)

Comp. Ogilby *On the characters and description of a new genus of Carnivora, Transact. of the Zool. Soc.* I. 1838, pp. 29—34, Pl. 3.

Sp. *Herpestes Steedmanni, Cynictis Steedmanni* OGILBY l. l.;—*Herpestes penicillatus, Cynictis Ogilbyi,* SMITH *Zool. of South Afr., Mamm.* Pl. 16, both from South Africa; according to TEMMINCK only one and the same species, in dress of different seasons. (*Cynictis melanura* is a species of *Herpestes, Herp. badius.*)

c) *With both fore and hind feet tetradactylous.*

Sub-gen. *Bdeogale* PETERS.

Sp. *Viverra crassicaudata, Bdeogale crassic.* PETERS *Mossamb., Mamm.* Pl. 27;—*Viverra puisa, Bdeogale puisa* PETERS, *ibid.* Pl. 28, both from South Africa.

Note.—In *Herpestes* the orbit, from the junction of the processes of the superior maxillary and frontal bones, is often closed by a ring posteriorly, which, however, is not perpetual and in some depends upon advanced age.

Galidia ISID. GEOFFR.

Comp. ISID. GEOFFR. SAINT-HILAIRE, GUÉRIN *Magas. de Zool.* 1839, *Mamm.* Pl. 14—17.

Sp. *Galidia elegans* ISID. GEOFFR. Pl. 14, &c. Small species from Madagascar, which appear to stand half-way as it were between *Herpestes* and *Viverra,* and are regarded by WAGNER as a sub-genus of *Herpestes.* The first false molar of the upper jaw is very small and sometimes falls out; in the lower jaw there were constantly, in the skulls examined by GEOFFROY, only 5 molars. (Such was also the case in the two skulls examined by me. This difference is however, in my opinion, less interesting than that of the entire form of the skull, which in the elongation and flattened curvature of the upper surface has a greater resemblance to that of the *Mustelæ* than of the *Ichneumons.*)

Rhyzœna ILLIG. Molar teeth $\frac{5-5}{5-5}$, false $\frac{2-2}{3-3}$, tuberculate $\frac{2-2}{1-1}$; (i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{3-3}{3-3}$, m. $\frac{2-2}{2-2}=36$, OWEN). All the feet tetradactylous, with claws, especially of the fore feet, long, compressed, incurved. Two glandular, anal follicles. Tail longer than half the body. (Orbit closed by a perfect osseous ring.)

Sp. *Rhyzœna suricatta, Viverra tetradactyla* PALL., BUFF. XIII. Pl. 8, SCHREB. *Säugth.* Tab. 117, 117 B, CUV. *R. Ani., éd. ill., Mamm.* Pl. 39, fig. 2, GUÉR. *Iconogr., Mammif.* Pl. 17, fig. 3, (fig. of cranium and of feet); the *zenik* or *suricate* of Africa, especially South Africa, a small *Ichneumon,* grey with darker transverse bands; the tail is ruddy, with a black tuft at the tip.

Crossarchus F. CUV. Molar teeth $\frac{5-5}{5-5}$, false $\frac{2-2}{2-2}$, laniary tooth with conical, acuté tubercles. Nose produced, proboscidian. Ears small. Feet pentadactylous, plantigrade. Tail moderate,

shorter than body. Anal glandular follicle. (Orbit not circumscribed posteriorly.)

Sp. *Crossarchus obscurus* GEOFFR. SAINT-HIL. and F. CUV. *Mamm.* Livr. 47, CUV. *R. Ani., éd. ill., Mamm.* Pl. 39, fig. 3; *le mangue;* on the west coast of Africa; feeds on small mammals, insects and fruits.

Cryptoprocta BENNETT.

Sp. *Cryptoprocta ferox* BENNETT, *Trans. Zool. Soc.* I. pp. 137—140, Pl. 21; Madagascar. (A young specimen of this animal, from which the dental formula could not be determined. The feet are pentadactylous, plantigrade; the claws retractile. It is not known to me from personal inspection.)

Paradoxurus F. CUV., *Platyschista* OTTO. Molar teeth $\frac{6-6}{6-6}$ (as in the *Viverræ*). Laniary tooth, especially the lower, thick, with conical tubercles. Feet plantigrade, pentadactylous, with toes conjoined by skin, the pollex not raised. Tail long, cylindrical, sometimes voluble, never prehensile. Naked area or glandular fold between the anus and the genitals. (Orbit not circumscribed posteriorly.)

Sp. *Paradoxurus typus* F. CUV. *Mammif.* Livr. 24, (1821), GUÉR. *Iconogr., Mamm.* Pl. 17, fig. 1; brown with darker spots; the specimen observed by F. CUVIER carried its tail turned spirally; from this he borrowed the less correct name of the genus, which, however, has been generally adopted. This species is from the continent of India, Madras, &c. (BUFFON had previously caused this species to be figured, from a specimen exhibited in a fair, under the name of *Genette de France, Suppl.* III. Pl. 47, p. 238.) Other species occur in the East Indies, of which in Java the most common is *Paradoxurus Musanga* GRAY, *Viverra Musanga* RAFFLES, HORSF. *Zool. Research. in Java,* No. 1; found also in Borneo, Sumatra and Timor.—*Paradoxurus binotatus* TEMM. (*Par. Hamiltoni* GRAY), is a species from the west coast of Africa; see TEMMINCK *Esquisses Zool.* p. 119. These animals live more on fruits than on animal food, and sleep by night on trees.

Compare on this genus TEMMINCK *Monogr. de Mammal.* II. 1841, pp. 312—344, with figures of the skull and the skeleton of *Paradoxurus trivirgatus* GRAY, TEMM.

Note.—Amblyodon JOURDAN (*Comptes rendus,* 1837), is a species of *Paradoxurus,* namely *Parod. Philipensis* OGILBY (TEMM. *Monogr.* II. p. 339), *Parad. Jourdanii* GRAY.

Potamophilus SAL. MUELLER, *Cynogale* GRAY, *Lamictis* BLAINV. Molar teeth $\frac{6-6}{6-6}$ (as in the *Viverræ*); laniary tooth tuberculate. Ears small. Snout produced, obtuse, depressed. Bristles at the

lips and behind the eyes very long. Feet short, pentadactylous, plantigrade. Tail short. (Orbit open behind. Habit, especially of the head, of *Lutra*.)

Sp. *Potamophilus barbatus* SAL. MUELLER, *Tijdschrift voor. nat. Gesch.* v. 1838, pp. 140—145; *Verhand. over de Overzeesche Bezittingen, Mamm.* pp. 115—120, Pl. 17, Borneo; keeps in the neighbourhood of rivers; length 1′ 11″, tail 7″.

Family XXXV. *Canina*. Molar teeth mostly $\frac{6-6}{7-7}$ (more rarely $\frac{7-7}{7-7}$ or $\frac{8-8}{8-8}$), two, more rarely three, tuberculate on each side in both jaws. Tongue smooth. Feet digitigrade, anterior almost always pentadactylous, with pollex raised, small, posterior tetradactylous[1]. No anal follicle, but in many a dermal gland above the base of the tail.

A small and very natural group, which corresponds to the genus *Canis* of LINNÆUS, with which, however, he united incorrectly the *Hyænas*.

Otocyon. LICHTENST., WAGN. Molar teeth $\frac{8-8}{8-8}$, spurious $\frac{3-3}{4-4}$, tuberculate $\frac{4-4}{3-3}$; laniary tooth less than the tuberculate; lower tuberculate teeth with oblong crown and four conical, acute tubercles. Ears large, nearly of the length of head, erect. Tail moderate, hairy.

Sp. *Otocyon caffer* LICHTENST., *Canis megalotis* DESM., *Canis Lalandii* HAM. SMITH *Dict. class. d'Hist. nat., Atl.*, Livr. 4, Pl. 147, fig. 2, GRIFFITH *Anim. Kingd.* II. p. 372, (fig. cop. in KRAUSS l. l. Tab. 11, fig. 3); greyish; tail black above and at the extremity; smaller than a fox; South Africa.

Canis L. (except *Hyæna*). Molar teeth $\frac{6-6}{7-7}$[2], spurious $\frac{3-3}{4-4}$, tuberculate $\frac{2-2}{2-2}$. Upper laniary tooth bilobed, acute, with a small additional tubercle forwards on the inside, the lower tripartite, the two anterior portions conical, acute, the posterior depressed,

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[1] Sometimes in the common dog (*Canis familiaris* L.) the hind feet are provided with five toes; in some the phalanges of this supernumerary toe are not connected with the tarsus, but only with the skin, in others the toe is fully developed. F. CUVIER *Ann. du Mus.* XVIII. pp. 342, 343, Pl. 19, fig. 10.

[2] In a skull of an American species (*Canis Azaræ* or *Canis cancrivorus?*) I found 7 molars in the upper jaw also.

tuberculate. (Dent. form. OWEN, i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{4-4}{4-4}$, m. $\frac{2-2}{3-3}=42$.)

a) *Vulpes. Pupil oblong. Tail moderate, brushed with hair.*

Sp. *Canis Zerda* ZIMMERM., *Canis Cerdo* GM., *Megalotis Zerdo* ILLIG., *Fennecus Brucei* DESMAR., *Encycl. méth., Mammif.* Pl. 108, fig. 4, RUEPPELL *Zool. Atlas,* Tab. II.; light isabel-coloured; white below; very long ears; the tail above at the base and at tip blackish; lives in the sandy plains of Nubia. This small species was formerly regarded by some as a *Viverra,* by GEOFFROY, on account of its long ears, as a species of *Otolicnus,* but has now found its true place in the canine genus. Compare also F. S. LEUCKART in OKEN'S *Isis,* 1825, pp. 211 foll. (With *Otocyon* this animal agrees in the long ears only; it does not differ in the teeth from the other species of dog.) Allied to it is *Canis famelicus,* RUEPPELL *Zool. Atlas,* Tab. 5, from the same district.

Canis viverrinus TEMM., *Nyctereutes viverrinus* TEMMINCK, *Fauna Japan., Mamm.* p. 40, Tab. 8; a small species with shorter very thickly-haired tail, short ears; grey-brown; on the top of the head pale yellow; the tail and the legs blackish. (In the teeth I can find no difference that indicates a distinct genus; the skeleton has 14 pairs of ribs and 6 lumbar vertebræ, whilst the rest of the species of dog have 13 pairs of ribs and 5 lumbar vertebræ.)

Canis Lagopus L. (and *Canis Isatis* GMEL., THIENEM.), SCHREB. *Säugth.* Tab. 93, TILESIUS *Nov. Act. Acad. Cæs. Nat. Curios.* XI. 1823, Tab. 47, pp. 375—388; the *isatis, pool-* or *ijsvos;* very short, round ears; the feet much haired below, in summer grey or dirty brown, in winter white; length of the head and trunk 2, tail 1'; this species lives in Lapland, Iceland, Siberia, Kamschatka and North America. The skin is sought for as a fur, especially that of a lead-coloured or bluish-brown variety.

Canis Vulpes L., BUFF. VII. Pl. 4, SCHREB. *Säugth.* Tab. 90, GUÉR. *Iconogr., Mammif.* Pl. 16, fig. 1, the *fox;* a little larger than the preceding species; triangular pointed ears; colour ruddy brown; commonly the tip of the tail is white, sometimes black (*Canis alopex* L.). This species is with some varieties met with throughout the whole of Europe, North Africa, North Asia and North America (*Canis fulvus* DESMAR.). It is a circumspect animal, digging holes; from its cunning a chief personage in the fabulous tales of ancient and modern times.

The strong-smelling secretion above the base of the tail (in a gland which the huntsmen of Germany name *Viole*[1]) cannot any longer be considered as an important characteristic of foxes, now that RETZIUS has discovered dermal glands in the same situation in the wolf also. See MUELLER'S *Archiv,* 1849, s. 429.

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[1] G. F. D. AUS DEM WINCKELL *Handbuch für Jäger,* 2te Auflage. Leipzig, 1822, III. s. 65, 66, 70.

b) *Lupus. Pupil rounded. Tail somewhat short, clothed with short hair.*

Sp. *Canis Lupus* L., BUFF. VII. Pl. 1, SCHREB. *Säugth.* Tab. 88, CUV. *R. Ani., éd. ill., Mammif.* Pl. 36, fig. 3; the *wolf;* commonly yellowish grey, below dirty yellowish-white; attains a length of 4 feet to the base of the tail, whilst the tail, which is carried nearly straight and hanging downwards, is 1′ 4″ long. This species lives especially in forests, and occurs in nearly the whole of Europe, and is numerous, particularly in Norway and Sweden, in the north of Africa, in North Asia and North America. A black variety is described as *Canis Lycaon* SCHREB., ERXLEB.; fig. in BUFF. IX. Pl. 41.

Canis aureus L., SCHREB. *Säugth.* Tab. 94, TILESIUS l. l. Tab. 48; the *jackal, chakal, goudwolf;* ruddy grey, on the back darker or blackish, the throat whitish; smaller than the wolf. This species lives in Asia, in the Caucasus and in Tartary, in Europe, in Dalmatia and the Morea, in North Africa. PALLAS regards this species as the ancestor of the domestic dog[1].

Canis familiaris L.[2]; *the dog;* the tail curled upwards (*cauda recurvata*). This well-known domestic animal, of which there are many varieties, has followed man throughout the world. The dog grows for 2 years, lives 15, at most 20 years; the period of gestation is 9 weeks; the young are born blind. To which species the original ancestors of the dog belonged is unknown, and on a subject, as to which so little can be determined with certainty, the opinions are very divergent. The most original races of dogs resemble the wolf and have straight ears. It is possible that wolves and jackals may have contributed to produce the numerous canine races now in being. It is probable, nevertheless, that one or more original races existed which attached themselves to man and remained with him as faithful followers, and that from these the very different races derived their origin. NILSSON *Skand. Fauna*, I. p. 242.

There is a species of dog with fore feet having only 4 toes, which is yellow with black and white spots, and which in the long, wide ears has some resemblance to a *Hyæna*, for which it was at first taken. The teeth, however, plainly indicate that this animal belongs to the canine genus. *Canis pictus* DESMAR., RUEPPELL *Zool. Atl.* Tab. 12, CUV. *R. Ani., éd. ill., Mammif.* Pl. 37, fig. 2; it is met with in S. Africa and Kordofan.

Icticyon LUND, *Cynalicus* GRAY. Molar teeth $\frac{5-5}{6-6}$, with a single tuberculate tooth on each side above and below.

Sp. *Icticyon venaticus* LUND, *Danske vidensk. Selsk. Afhandl.* XI. 1845, pp. 61—72, Tab. 41. On the genus *Icticyon* of LUND see *Natuur-en Wiskund. Verh. der koninkl. Akad. van Wetenschappen*, III. 1855, with fig. of the skull.

Family XXXVI. *Mustelina.* Molar teeth four or five on each side in upper jaw, five, or more rarely six, in lower jaw.

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[1] HUNTER even supposed that the wolf, jackal and dog, form only one species, *Phil. Transact.* 1787, p. 253, 1789, p. 160.

[2] See the enumeration of the races of this in ERXLEBEN and GMELIN *Syst. nat. ed.* XIII. I. pp. 66—69.

Single tuberculate tooth on each side in both jaws. Feet pentadactylous, often plantigrade; claws not retractile. Snout abbreviate, rounded; cranium elongate, protracted behind the jaws. (Condyle of lower jaw cylindric, transverse, strictly inclosed in the glenoïd cavity by exsert lines. Cœcum absent.)

The head of these animals is round forwards like that of the cats, but the distance from between the orbits to the great occipital foramen is remarkable, so that the skull has a much elongated form at the back part.

Lutra RAY, STORR, ILLIG. (Spec. of *Mustela* L.) Molar teeth $\frac{5-5}{5-5}$, upper laniary tooth very large, with large accessory tubercle internally, the lower tuberculate posteriorly. Ears small, remote. Feet palmate, short. Body elongate. Tail short, round, somewhat depressed towards the tip, flat beneath. (Dent. form. OWEN, i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{4-4}{3-3}$, m. $\frac{1-1}{2-2} = 36$.)

Enhydra FLEMING[1], *Enhydris* LICHTENST. Lower incisor teeth (in adults) four. Ears very small, placed at the sides of head below the eyes. Fore feet short, with toes connate, densely haired, the hair covering the claws; posterior feet remote from anterior, large, with outer toe longest of all. Tail short.

Sp. *Lutra marina* ERXL., DESM., *Mustela lutris* L., COOK *Third Voyage, Atlas*, Pl. 97, SCHREB. *Säugth.* Tab. 128, LICHTENST. *Darstellung*, Tab. 43, 50, KRAUSS l. l. Tab. 10, fig. 6. The *sea-otter* attains a length of more than 3 feet; the tail is 7½ inches long; the colour of the fur is dark brown or black and shining. This species lives on the islands of the west coast of North America, and was formerly also found upon the islands of the opposite coast of Asia and at Kamschatka. (See on the chase of these animals, amongst others, O. VON KOTZEBUE *Reise um die Welt, in d. J.* 1823—1826, II. s. 24—26.)

In *Lutra*, as in many other *Mustelina*, the second incisor of the under jaw, counting on each side from the canine, is placed almost behind the third or middle one. The first two or middlemost in *Lutra marina* fall out early, and hence those behind them take their place, so that there are then only four incisors in the lower jaw.

Anatomical particulars of the sea-otter have been also given by HOME *Philos. Transact. for* 1796, pp. 385—394, Pl. 8—10.

Pteronura GRAY, *Pterura* WIEGM. Tail moderate, surrounded by a lobed cutaneous border. Characters of *Lutra*. Feet large, palmate, with toes apart.

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[1] *Philosophy of Zoology*, Edinburgh, 1822, II. p. 187.

Sp. *Pterura Sambachii, Annals and Mag. of Nat. Hist.* II. 1839, Pl. 14; Demerara.

Lutra (auctor., in stricter sense). Incisor teeth above and below six. Tail moderate. Middle toes longer than outer. Ears placed higher than eyes.

Sp. *Lutra vulgaris* ERXL., *Mustela Lutra* L., BUFF. l. l. VII.-Pl. 11, SCHREB. *Säugth.* Pl. 126; CUV. *R. Ani., éd. ill, Mammif.* Pl. 35, fig. 3; the *otter* lives in Europe, the northern and temperate parts of Asia[1], in Japan, on the banks of rivers, and feeds on fish and frogs. In North America a very similar species occurs, which is distinguished as *Lutra canadensis* SCHREB. —All the species of this genus much resemble each other, are usually similarly coloured also, red-brown with white throat.

DE LA LANDE discovered at the Cape of Good Hope a species which has no claws on the fore feet (and at the adult period loses those of the hind feet, except some vestiges of them): *Lutra inunguis* F. CUV.—LESSON has formed from it the genus *Aonyx*.

Mustela L. (excl. of some species). Molar teeth $\frac{5-5}{6-6}$ or $\frac{4-4}{5-5}$, with three or two false teeth on each side above, four or three below; upper tuberculate tooth with crown broader than long. Ears short, rounded. Toes separate. Tail of various length in various species, mostly moderate.

On the whole these animals are small and, with the exception of the insectivorous animals (*mole, shrew,* &c.), the smallest of this order. Some species are much sought for on account of their fur, and form a principal article of the fur-trade. The skeleton has usually 14 pairs of ribs and 6 lumbar vertebræ.

a) With false molars $\frac{2-2}{3-3}$. (Sub-genus *Putorius* CUV. Dent. form. OWEN, i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{3-3}{3-3}$, m. $\frac{1-1}{2-2} = 34$.)

Sp. *Mustela putorius* L. BUFF. VII. Pl. 23, SCHREB. *Säugth.* Tab. 131, CUV. *R. Ani., éd. ill., Mamm.* Pl. 34, fig. 1; the *pole-cat, le putois, der Iltiss, de bonsem,* 1′4″ or 1′5″ long, tail 7″; brown, head whitish, legs and tail black; dispersed over a great part of Europe and temperate countries of Asia.—*Mustela erminia* L., BUFF. VII. Pl. 29, fig. 2, Pl. 31, fig. 1, SCHREB. *Säugth.* Tab. 137 A, B; the *ermine-weasel,* smaller than the preceding species (female larger than male), in the summer red-brown, in winter white, except the tip of the tail, which is black; a much-prized fur. —*Mustela vulgaris* L., BUFF. VII. Pl. 29, fig. 1; *the weasel, la belette;* small-

[1] The species of Otter of Pondicherry appears not to differ; F. CUVIER has recorded it under the name of *Lutra nair, Dict. des Sc. nat.* XXVII. p. 247; fig. in GUÉRIN *Iconogr., Mammif.* Pl. 15, fig. 3.

est species, only 7 or 8″ long, tail very short, 2″; red-brown above, or light ruddy, tail of the colour of back, the under side white; only in the far north has this species also a white winter-coat as the rule.—*Mustela barbara* L., *Gulo canescens* ILLIG., BUFF. *Suppl.* VII. Pl. 60, SCHREB. *Säugth.* Tab. 143 B; Surinam, Brasil (WIEGMANN refers this species to the sub-genus *Galictis* BELL).—In a species from the East and North of Europe the toes are connected at the base by a hairy fold of skin, especially the two middle, longer toes: *Mustela lutreola* L., PALL. *Spic. Zool.* XI. 1; red-brown, the tail dark brown, the chin white.

β) *With false molars* $\frac{3-3}{4-4}$. (Sub-genus *Mustela* CUV.) p. $\frac{4-4}{4-4}$.

Sp. *Mustela canadensis* ERXL., GM., BUFF. XIII. Pl. 42, GUÉRIN *Iconogr., Mamm.* Pl. 15, fig. 1; the *pekan*, a large brown species, with long black tail; dispersed over a great part of North America.—*Mustela Martes* L., *Mustela abietum* RAY, BUFF. VII. Pl. 22; dark red or brown, feet black, the throat yellow; in many countries of Europe and temperate Asia, &c.

Galictis BELL. Molar teeth $\frac{4-4}{5-5}$, false $\frac{2-2}{3-3}$ (as in the Polecats). Feet subplantigrade, with palms and soles naked. Body depressed, elongate. Tail moderate, villous, subdistichous.

Sp. *Mustela vittata, Viverra vittata* SCHREB., GM., *Gulo vittatus* DESM., BUFF. *Suppl.* III. Pl. 23, *Galictis vittata* BELL, *Trans. of the Zool. Soc.* II. Part 3, 1839, pp. 201—208, Pl. 35; yellowish-grey above, under side and legs black; Guiana, Brasil.—*Mustela Allemandi, Galictis Allemandi* BELL l. l. Pl. 37 (BUFF. *Suppl.* III. Pl. 25, cop. in SCHREBER *Säugth.* Tab. 124? Description and figure of ALLEMAND from a specimen not adult); larger, brown, black below, a greyish-white strip from the eyes over the ears; Chili.

Mephitis CUV. (Spec. of *Viverra* L., GM.). Molar teeth $\frac{4-4}{5-5}$, more rarely three above on each side; laniary tooth very large; upper tuberculate large, with crown square or transverse. Ears short, rounded. Snout somewhat prominent or proboscidean. Feet pentadactylous, short, almost plantigrade, with claws of fore feet large, fossorial. Body elongate. Tail moderate or somewhat long, with long hair. (Dental formula as in *Putorius*.)

Compare H. LICHTENSTEIN *Ueber die Gattung* Mephitis, *Eine akademische Abhandlung* (*Ak. der Wissensch. zu Berlin, Physik. Kl.* 1836), 1838, 4to.

Rhabdogale WIEGM., WAGN. Molar teeth $\frac{4-4}{5-5}$. Upper laniary tooth with accessory tubercle internal, anterior.

Sp. *Mephitis mustelina, Rhabdogale mustelina* WAGN., *Mustela zorilla* DESM., *Mephitis africana* LICHTENSTEIN, SCHREB. *Säugth.* Tab. 133 A, GUÉR.

Iconogr., Mamm. Pl. 14, fig. 3; the *muishond* of the Cape colonists, black, with white spot on the head and four white stripes running from the neck along the back and diverging from one another. Dispersed over a large part of Africa, also in Abyssinia and Nubia (*Mephitis lybica* EHRENB.). The skeleton has 15 pairs of ribs and 5 lumbar vertebræ.

Mephitis LICHTENST. (in stricter sense). Molar teeth $\frac{4—4}{5—5}$. Upper laniary tooth with internal middle accessory tubercle.

Sp. *Mephitis zorrilla* LICHTENST., *Viverra putorius* L., BUFF. XIII. Pl. 41, SCHREB. *Säugth.* Tab. 123; black, or dark brown, with four yellowish-white stripes along the back and one on each side, that bends from behind upwards; Mexico, &c. (We are inclined to regard as a variety of this species *Mephitis interrupta* RAFINESQUE, LICHTENST. l. l. Tab. II. fig. 1, from the Missouri. Here probably belongs a figure of CATESBY, which occurs in BUFFON, with some alteration, under the name of *Conepate*, XIII. Pl. 40).—*Mephitis mesomelas* LICHTENST., *Darstell.* Tab. 45, fig. 2, CUV. *R. Ani., éd. ill., Mamm.* Pl. 35, fig. 1, under the name of *Mephitis putorius*;—*Mephitis Westermanni*, J. REINHARDT *Kongel. Danske Videnskabernes Selskabs Schrifter*, 5te Raekke. *Naturvid. og math. Afdeling*, IVter Bd. 1857.

Thiosmus LICHTENST. Molar teeth $\frac{3—3}{5—5}$.

Sp. *Mephitis mapurito, Viverra mapurito* GMEL. &c. Comp. LICHTENSTEIN l. l.

Mydaus F. CUV. Molar teeth $\frac{4-4}{5-5}$, (as in *Mephitis*). Snout produced, proboscidean. Ears very small, immersed in fur. Feet plantigrade. Claws of fore feet large, compressed, somewhat straight. (Dent. form. OWEN, i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{3-3}{3-3}$, m. $\frac{1-1}{2-2} = 34$).

Sp. *Mydaus meliceps* F. CUV., *Mephitis javanensis* DESM., F. CUV. *Mammif.* Livr. 27, HORSFIELD *Zool. Res. in Java*, No. II. (with figure of skull), CUV. *R. Ani., éd. ill., Mamm.* Pl. 35, fig. 2; a small animal of the length of full 1′, brown or black, with a narrow longitudinal white stripe in the middle of the back; the tail is very short; Java, on the high mountain-ranges only. By a very thin but longer tail is distinguished *Mydaus collaris* GRAY, *Arctonyx collaris* F. CUV. *Mammif.* Livr. 51, the *Bali-saur*, of Hindostan.

Helictis GRAY, *Melogale* ISID. GEOFFR. (Spec. of *Mydaus* TEMM.). Molar teeth $\frac{5—5}{6—6}$, with upper tuberculate tooth transverse. (A genus allied to the preceding, but with larger ears, and smaller claws, more incurved.)

Sp. *Gulo orientalis* HORSF., *Zool. Res.* No. II, *Melogale fusca* ISID. GEOFFR., GUÉR. *Magas.* 1835, Cl. I. Pl. 16; Java, &c.

Meles STORR (Spec. of genus *Meles* BODD.). Molar teeth $\frac{5-5}{6-6}$, false $\frac{3-3}{4-4}$, with first upper very small, deciduous. Lower laniary tooth with tubercles and internal process. Upper tuberculate tooth very large, lower often wanting through age. Glandular follicle under tail. Feet plantigrade; claws of fore feet large, fossorial. Tail short. Body depressed, covered with long, setose hair. (Dent. form. i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{4-4}{4-4}$, m. $\frac{1-1}{1-1}=36$, OWEN.)

Sp. *Meles vulgaris* DESM., *Meles taxus* BODD., *Ursus Meles* L., BUFF. VII. Pl. 7, SCHREB. *Säugth.* Tab. 142, GUÉR. *Iconogr., Mamm.* Pl. 14, fig. 1; the *badger, le blaireau, der Dachs;* grey above, the belly and legs black; a black stripe obliquely from the eyes along the whitish head; in Europe and Northern Asia.—*Meles labradoria* SAY, WAGN., *Meles hudsonius* CUV., BUFF. *Suppl.* III. Pl. 49, RICHARDSON *Faun. bor. Am.* I. Pl. 2; very like the preceding, but somewhat smaller, ruddy grey, with white under surface; claws longer. Compare on the skull of this species WATERHOUSE *Zool. Transact.* II. 5, 1841, pp. 343—348, Pl. 59.—*Meles amakuma* TEMM. *Faun. Japon., Mammal.* Pl. 6.—The badgers are nocturnal animals, which dig holes and live principally on vegetable food.

Mellivora STORR, F. CUV., *Ratelus* SWAINSON, WAGN. Molar teeth $\frac{4-4}{4-4}$, false $\frac{2-2}{3-3}$; tuberculate tooth in upper jaw only one on each side, transverse. Lower laniary tooth with margin acute, tricuspidate, upper with conical anterior and inner tubercle. Cutaneous border around the external auditory meatus, rudiment of ear. Short plantigrade feet, the anterior with large claws. Head short. Hair long, rigid. (Dent. form. OWEN, i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{3-3}{3-3}$, m. $\frac{1-1}{1-1}=32$.)

Sp. *Mellivora capensis, Viverra capensis* (and *Viv. mellivora*) GM., SCHREB. *Säugth.* Tab. 125, CUV. *R. Ani., éd. ill., Mammif.* Pl. 33, fig. 4; above grey, below black, a white stripe where the two colours separate. This species lives at the Cape of Good Hope, in Mosambique, &c. It digs out the nests of wild bees, which it finds by observing and following these insects at evening time; feeds also on birds, rats and snakes (PETERS). The absence of the tuberculate tooth in the lower jaw is a remarkable anomaly of this family, but in other respects the molars almost correspond with those of *Galictis* (see above, p. 715).—*Mellivora indica, Ursus indicus* SHAW, HARDWICKE, LINN. *Trans.* IX. p. 115, BENNETT *Gard. and Menag. of the Zool. Soc.* I. pp. 13—20; much resembling the preceding, but without

the white lateral stripe and with shorter tail; lives in the northern part of India.

Gulo STORR. Molar teeth $\frac{5-5}{6-6}$, false $\frac{3-3}{4-4}$. Upper tuberculate tooth transverse, lower small, with crown oblong and rounded. (Laniary tooth as in the preceding genus). Ears short, rounded. Feet subplantigrade. Tail short. (Dent. form. OWEN, i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{4-4}{4-4}$, m. $\frac{1-1}{2-2}=38$.)

Sp. *Gulo arcticus* DESMAR., *Mustela Gulo* L., *Ursus Gulo* PALL., GM., SCHREB. *Säugth.* Tab. 144, 144*, GUÉR. *Iconogr., Mammif.* Pl. 14, fig. 2; the *glutton, le glouton, der Vielfrass;* red-brown, on the back dark brown, 3′ in size; in Lapland, Finland and the North of Asia and Canada; preys by night, and attacks reindeers and other large animals by leaping from trees on their neck; compare PALLAS *Spic. Zool.* XIV. pp. 25—41.

(The North American glutton, which does not appear to be a different species, occurs in LINNÆUS under the name of *Ursus luscus.*)

Family XXXVII. *Ursina.* Two tuberculate teeth on each side in upper jaw, one or two in lower. Laniary molar nearly resembling the tuberculate tooth, with crown flat, thicker. Feet plantigrade, covered below with hairless skin, pentadactylous.

Ursus L. (excl. of some species). Molar teeth $\frac{6-6}{7-7}$, false $\frac{3-3}{4-4}$, often deciduous, tuberculate $\frac{2-2}{2-2}$, with last upper and penultimate lower, very large. Laniary tooth with flat, tuberculate crown. Nose produced, mobile, truncate anteriorly. Ears small, erect, rounded. Tail very short. (Dent. form. OWEN, i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{4-4}{4-4}$, m. $\frac{2-2}{3-3}=42$.)

The *Bears.* Species of this genus are found in almost all regions of the earth. They are in part animals that live on vegetable as well as animal food. They dilacerate flesh, not with their molars, which are little suited to that use, but with the incisors only. When excited they raise themselves upright on their hind feet and strike with their fore feet.

Sp. *Ursus Arctos* L., BUFF. VIII. Pl. 31, SCHREBER'S *Säugth.* Tab. 139, 140, *Ménag. du Mus.* I. pp. 177—198; figures of the skull may be found in *Ann. du Mus.* VII. Pl. 21, figs. 1—4; the *common* or *brown bear;* hair brown, close, woolly; head forwards between the eyes convex; snout pointed. This species lives in forests and mountainous districts of many countries of Europe and Asia; it feeds on fruits, roots, honey, ants, and, in case of need, on mammals also. The bear attains a great age; when

young there is often a white band round the neck.—*Ursus americanus* PALL., SCHREB. *Säugth.* Tab. 141 B, *Ménag. du Mus.* II. pp. 144—155 (figures of the skull in *Ann. du Mus.* l. l. fig. 5, 6); hair black and shining, the forehead flat; this species lives in North America. Another somewhat larger species, chiefly distinguished by its long claws, lives in the interior of North-western America: *Ursus ferox* LEWIS and CLARKE, *Ursus cinereus* DESMAR., RICHARDSON *Fauna boreali-Americana*, I. p. 24, Pl. I. The Prince MAX. VON WIED has given recently a beautiful coloured figure of this bear, and a careful drawing of its skull, *Verhandl. der Kaiserl. Leopold. Carol. Akad. der Naturforsch.* Vol. XXVI. 1. 1857.—*Ursus maritimus* L., *Ursus marinus* PALL., *Spic. Zool.* XIV. pp. 1—24, Tab. I. SCHREB. *Säugth.* Tab. 141, BLUMENB. *Abbild.* No. 33, *Ménag. du Mus.* I. pp. 55—68; the *ice-bear*. This species lives in the polar regions, more on the ice and in the sea than on the land, and feeds on fish, seals, &c. The ice-bear is white with nose black, not hairy; it has an elongate head, shorter ears, and the soles of the feet longer than in the brown bear; it is the largest of this genus, and attains a length of 7 feet.—*Ursus labiatus* BLAINV., *Ursus longirostris* TIEDEM., *Bradypus ursinus* SHAW, *Naturalists' Miscellany*, XIX. (London, 1792), TIEDEMANN *Abhandlung über das vermeintliche bärenartige Faulthier*, mit einer *Abbild.* Heidelberg, 1820, 4to; REICHENBACH in *Nov. Act. Acad. Cæs. Nat. Cur.* XIII. 1, p. 325 (with a col. fig.); H. DE POMMERESCHE *Commentatio de Ursi longirostris sceleto*, Berolini, 1829, 4to; in Bengal; this animal was formerly referred incorrectly to the genus *Bradypus* (or to a distinct genus of edentates, *Prochilus* ILLIGER), because the specimen first observed had accidentally lost the incisor teeth.

Different species of bears belonged to an earlier creation, to the diluvial period chiefly, of which the remains have been found in caverns of limestone-mountains that are filled with stalactites. These bones are but slightly changed, and only somewhat lighter and more brittle than the recent. The species occurring most frequently is *Ursus spelæus* BLUMENB., of which the size surpassed that of the largest ice-bear. Compare CUVIER *Ann. du Mus.* VII. pp. 301—372, Pl. 18—24, and *Rech. s. les Ossem. foss.*, 3ième éd., IV. pp. 340—380.

Procyon STORR. Molar teeth $\frac{6-6}{6-6}$, false $\frac{3-3}{4-4}$, tuberculate $\frac{2-2}{1-1}$; upper laniary tooth with internal central conic tubercle; lower laniary tooth oblong, thick, almost similar to the tuberculate tooth. Snout acute. Toes cloven. Tail moderate. (Dent. form. OWEN, i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{4-4}{4-4}$, m. $\frac{2-2}{2-2}=40$.)

Sp. *Procyon lotor* DESMAR., *Ursus lotor* L., BUFF. VIII. Pl. 43, SCHREBER *Säugth.* Tab. 143, BLUMENB. *Abbild.* No. 62, GUÉRIN *Iconogr., Mammif.* Pl. 12, fig. 2, *Dict. univ. d'Hist. nat., Mammif.* Pl. 7 B; the *racoon, le raton, der Waschbär;* greyish-brown, the head above the eyes white, an oblique black streak on each side below the eyes; the tail with black rings; this species lives in North America. The racoon dips its food in water before using it.—*Procyon cancrivorus* ILLIG., DESM., *Ursus cancrivorus*

Cuv., Buff. *Suppl.* vi. Pl. 32; ruddy brown; in Brasil. I have given figures of the skull and the teeth in *Nov. Act. Acad. Cæs. Leop. Carol.* xix. 1, 1838, Tab. xx. figs. 2, 3, 5.

Nasua Storr. Molar teeth $\frac{6-6}{6-6}$, (as in the preceding genus, but smaller, the inferior narrower; canine teeth compressed, with apex acuminate). Nose produced into a mobile proboscis, with upper margin acute, somewhat prominent. Toes conjoined by skin. Claws compressed, incurved, large. Tail long. (Dental formula as in the preceding genus.)

A genus very closely allied to the preceding, so that the two might perhaps be united without violence, as I did formerly (first edition of this *Handbook*, ii. p. 642, *Nov. Act. Cæs. Leop. Carol.* xix. 1, pp. 183, 184). These animals, with the racoons, represent in the new world the *Lemurids* of the Eastern hemisphere. They climb trees, living partly, and even by preference, on fruits, hunt small birds, and eat eggs with avidity. Compare Maxim. *Beiträge zur Naturgesch. von Bras.* ii. s. 283—292; Burmeister *Uebersicht der Thiere Bras.* s. 117—121.—Sp. *Nasua socialis* Princ. Maxim., *Viverra nasua* L., *Nasua rufa* Desmar., Buff. viii. Pl. 47 (cop. in Schreb. *Säugth.* Tab. 118), Guér. *Iconogr., Mammif.* Pl. 13, fig. 3 (and *Viverra narica* L., Buff. viii. Pl. 48, Schreb. *Säugth.* Tab. 119). The *Coati;* Brasil, Surinam. According to the Prince of Neuwied the colours cannot determine any difference of species; these animals are brown or ruddy, with a long tail which shews black rings more or less conspicuously. Of the skull and the teeth I have given a figure *loc. cit.* figs. 1, 4, 6.—The Prince of Neuwied adopts a second (larger) species under the name of *Nasua solitaria*, which has also been recognised as distinct by Rengger and Lund.—(*Nasua montana* Tschudi, *Fauna peruana* Tab. v.: is it distinct from *Nasua solitaria?*)

Ælurus (*Ailurus*) F. Cuv. Molar teeth $\frac{5-5}{5-5}$, a single unicuspidate false molar above on each side, the other four tuberculate, two tuberculate teeth on each side below. Ears rounded, small. Claws incurved, compressed, semi-retractile. Tail lax, moderate, at the base thick, villose.

Sp. *Ælurus fulgens* F. Cuv., *Mammif.* Livrais. 50, Guérin *Iconogr., Mammif.* Pl. 12, fig. 3, Cuv. *R. Ani., éd. ill., Mammif.* Pl. 31, fig. 2; Hardwicke, who equally with Duvaucel (or perhaps before), discovered this animal, has given a description and figure of the teeth, which I have not been able myself to investigate, *Linnæan Transact.* xv. 1, pp. 161—165, Pl. ii. (I should almost suppose that there is a small molar tooth behind the incisors which has fallen out, and that the normal number is six, as in *Nasua*.) The animal lives in Nepaul, attains the size of a large domestic cat, is chestnut-brown above, has breast, belly and legs black; the head is whitish with a red-brown spot under the eyes; the tail is red-brown with some darker rings.

Arctictis TEMM., *Ictides* VALENC., CUV. Canine teeth conical, compressed, acute; molars $\frac{6-6}{6-6}$, spurious $\frac{3-3}{4-4}$, conical; upper laniary tooth with crown broad, transverse, with external tubercle conical, separated by a deep longitudinal groove from internal flat tubercle; lower laniary tooth with crown oblong, depressed in the middle; last upper tuberculate tooth very small, with crown orbicular. Whiskers very long. Ears pencilled. Tail long, nearly equal to body, villous, thick at the base, prehensile. (Dent. form. OWEN, i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{4-4}{4-4}$, m. $\frac{2-2}{2-2}=40$.)

Sp. *Arctictis penicillata* TEMM., *Paradoxurus albifrons* F. CUVIER, *Mém. du Mus.* IX. 1822, Pl. 44, *Ictides albifrons* VALENCIENNES, *Ann. des Sc. nat.* IV. Pl. 1; the *benturong* or *binturong* (*musang* or *palm-civet*) lives in Malacca, Sumatra, Borneo and the western part of Java. The skull almost agrees in form with that of *Procyon;* I found in the two skulls examined by me only five molars on each side in the lower jaw.

Cercoleptes ILLIG., *Potto* CUV. Molar teeth $\frac{5-5}{5-5}$, small, the two anterior on each side in both jaws conical, remaining three tuberculate, with crown somewhat flat, the lower oblong, the upper transverse, hollowed in the middle. Face short, rounded. Tongue slender, exsertile. Tail elongate, voluble. (Dent. form. OWEN, i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{3-3}{3-3}$, m. $\frac{2-2}{2-2}=36$.)

Sp. *Cercoleptes caudivolvulus* ILLIG., *Viverra caudivolvula* PALL., VOSMAER *Beschrijving van een Amerikaansche wezel, Potto genaamd.* Amsterdam, 1771, 4to (with col. fig.), SCHREB. *Säugth.* Tab. 125 B, GUÉR. *Iconogr., Mammif.* Pl. 13, fig. 2; the teeth figured in F. CUVIER *Dents des Mammif.* Pl. 12, pp. 31, 32; yellowish-brown; this animal feeds on fruits, honey, insects, eggs, small birds, &c.; it lives in Guiana, New Granada, also in Peru, (V. TSCHUDI *Fauna*, pp. 105, 106); the *kinkajou.* The skull has some resemblance with that of the apes. On the anatomy compare OWEN *Procced. of the Zool. Soc.* 1835, pp. 119—124.

SECTION III. *Insectivora.*

Incisor teeth various in number, which is almost always different in the two jaws; no true canines in many, false molars with double root occupying their place; molar teeth with conical, acuminate tubercles. Feet plantigrade, often pentadactylous.

The *insectivorous mammals* are almost all small, and often present in their form much resemblance to the rodents. Many live under ground. All have a clavicle. In some the number of ribs is unusually large. The deciduous teeth of the moles and shrews are (OWEN *Odont.* p. 423) developed and disappear before birth.

Family XXXVIII. *Talpina.* Body hairy. Feet short, fore feet fossorial, with claws large. Ears none. Eyes very small or indistinct.

Chrysochloris LACEP. Incisor teeth $\frac{6}{6}$, the middle inferior small, narrow, true canines none, molars $\frac{7-7}{7-7}$, or $\frac{6-6}{6-6}$, with a vacant space between them, false molars $\frac{1-1}{2-2}$, small, the true with crown transverse, triangular in the upper, broader externally, in the lower compressed, linear, divided by a transverse groove. Eyes covered by skin. Nose naked, coriaceous, produced. Fore feet tetradactylous, with fourth toe very small, claw of third toe strong, broad, falciform; hind feet pentadactylous. Tail none. (The development of the teeth is unknown.)

Sp. *Chrysochloris capensis* DESMAR., *Talpa asiatica* L., *Sorex auratus* CUV., SCHREB. *Säugth.* Tab. 157, VOSMAER *Beschrijving van den groenglanzigen mol*, &c., Amsterdam, 1787, 4to (with col. fig.), GUÉRIN *Iconogr., Mammif.* Pl. XI. fig. 3; brown, the hair with a green and purple reflection, of the size of the mole. This species lives at the Cape of Good Hope, and not in Siberia, as stated by LINNÆUS on the assertion of SEBA. This genus reminds us of *Spalax* amongst the *glires*. Some other species also have been discovered in later times, all South African, as *Chrysochloris obtusirostris* PETERS, from Mosambique. The skeleton has 19 (in one species even 20) pairs of ribs. The first rib is thick and broad; the clavicle is long and thin. (In the distinction of the teeth we have, on the authority of PETERS, followed the view of BLAINVILLE; as also, in the number of toes of the fore feet, MECKEL *Beitr.* I. 2, p. 99, and PETERS.)

Condylura ILLIG., *Rhinaster* WAGLER, WAGN. Incisors $\frac{6}{4}$, two upper middle broad, triangular, rounded in front, lower procumbent, true canines none, molars $\frac{7-7}{8-8}$, spurious $\frac{3-3}{5-5}$, conical, distant. Muzzle produced into a slender proboscis, furnished at the apex with caruncles arranged radiately. Eyes very small. Feet pentadactylous. Tail moderate, thinly haired.

Sp. *Condylura cristata* DESM., *Sorex cristatus* L., GUÉR. *Iconogr., Mammif.* Pl. XI. *bis*, fig. 2; tail shorter than half the body, from North America, as is also *Condylura longicaudata* DESM.; these animals resemble the mole in mode of life and in form. Compare on this genus DESMAREST in OKEN'S *Isis*, 1823, s. 658—663, Taf. 8. (The name *Condylura* is founded on the fortuitous character, that the tail in dried specimens assumes a knotted form occasioned by the vertebræ.)

Talpa L. (excl. *Talpa asiatica*). Incisors $\frac{6}{8}$ (or $\frac{6}{6}$), true canines none, molars $\frac{8-8}{7-7}$, the first representing the canine (with the upper placed in front of the lower), tuberculate $\frac{3-3}{3-3}$. Nose produced, truncate at the point. Eyes very small. Feet pentadactylous; the sole of fore feet turned backwards, with toes connected, claws strong. Tail short or very short.

Sp. *Talpa europæa* L., SCHREB. *Säugth.* Tab. 156, GUÉRIN *Iconogr., Mammif.* Pl. XI. *bis*. fig. 1; the *mole;* 5 to 6″ long, tail 1″; a well-known animal that lives underground, feeds on insects and earth-worms, and has a very fine sense of hearing. Compare on this animal amongst others the description of DAUBENTON in BUFFON *Hist. nat.* Tome VIII. pp. 87—100, with many figures; BLASIUS *Fauna der Wirbelth.*, I. s. 109—114; J. F. MECKEL *Vergleichung der Osteologie des Europ. Maulwurfs und des Maulwurfs vom Kap*, &c. in *Beiträge zur vergl. Anatomie*, I. 2, 1809, s. 91—101 (on *Chrysochloris*, see above); F. G. J. JAKOBS *Talpæ europææ Anatome*, Jenæ, 1816, 8vo, cum Tab.; C. KOCH *De Talpæ europææ oculo*, Regiomonti, 1827, 8vo.—In Italy a species occurs in which the middle incisors are larger than the lateral, and the eyes are not furnished with any visible ocular fissure: *Talpa cœca* SAVI, BONAP. *Fauna Ital.* Fasc. II.—In Japan a species is found with only 6 inferior incisors; *Talpa wogura* TEMM. *Fauna Jap., Mamm.* Pl. IV. figs. 2, 3, 4, 5.

Urotrichus TEMM. Incisor teeth $\frac{2}{2}$, large, conical, true canines none, spurious molars $\frac{5-5}{4-4}$, the first upper conical larger, the other upper molars, especially the second, minute. Feet pentadactylous, with claws small, slender. Tail short, furnished with long hair.

Sp. *Urotrichus talpoides* TEMM. *Faun. Jap., Mamm.* Pl. IV. figs. 6—11; GUER. *Mag. de Zool.* 1842, *Mammif.* Pl. 55; smaller than the mole, very common in Japan; an intermediate form between *Talpa* and *Sorex*.

Scalops CUV. Incisor teeth $\frac{6}{4}$, the two middle upper large, rounded in front, the two lateral on both sides small, linear,

deciduous; two middle lower small; molars $\frac{7-7}{6-6}$, spurious $\frac{4-4}{3-3}$ distant, in place of canines, cylindric, acuminate at the apex[1]. Muzzle produced, with nose proboscidean. Eyes very small. Feet pentadactylous, (anterior resembling the feet of moles,) posterior palmate. Tail short, annulate, thinly haired.

Sp. *Scalops canadensis* DESM., *Sorex aquaticus* L., SCHREB. *Säugth.* Tab. 158, GUER. *Iconogr., Mamm.* Pl. XI. bis, fig. 3; on the banks of rivers in North America; somewhat larger than the mole, with which in form and mode of life it corresponds.

Family XXXIX. *Soricina.* Body covered by hair. Eyes distinct; ears in most. Feet not fossorial.

Myogalea FISCHER (*Synopsis Mamm.* p. 250), *Mygale* CUV. (*Anat. comp.* I. in the first synoptic table at the end of the volume; a name given by WALCKENAER to a genus of the *Araneæ*, and generally received). Incisors $\frac{2}{4}$, the upper large, broad, triangular, the two middle inferior small; true canines none; molars $\frac{10-10}{9-9}$, false molars $\frac{6-6}{6-6}$, true $\frac{4-4}{3-3}$, with crown quadrate. Nose proboscidean, depressed, mobile. Ears none. Feet pentadactylous, palmate. Tail long, thinly haired, compressed at the tip. Glandular follicles at the tail, arranged in a double row.

Sp. *Myogalea muscovitica* DESMAR., *Sorex moschatus* PALL., GMEL., *Castor moschatus* L., BUFF. X. Pl. 1, PALLAS *Act. Acad. Petropolit.* 1781, Part II. (1785), p. 315, Tab. 3 *et* 5 (*Anat.*), SCHREB. *Säugth.* Tab. 159, GUÉR. *Iconogr., Mammif.* Pl. XI. fig. 2; tail compressed through the entire length, shorter than the body; in the south-eastern part of Russia; compare

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[1] Commonly only two incisors are allowed to this animal in the upper jaw. I am of opinion, however, that the two which follow them on each side, so named false molars, ought also to be referred to the incisors, since, according to the figure of F. CUVIER (*Des dents des Mammif.* No. 22, p. 54), they are planted in the intermaxillary bone; in the skull examined by me they were wanting. RICHARDSON observed more false molars than F. CUVIER, and makes the total number of teeth in this genus 44 instead of 36 as above, *Fauna bor. Amer.* I. pp. 9, 10. It seems that LINNÆUS drew his character of the genus *Sorex* (*dentes primores inferiores 4, intermediis brevioribus*) from his *Sorex aquaticus*, i. e. from *Scalops*. According to OWEN the dental formula is i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{4-4}{4-4}$, m. $\frac{3-3}{3-3} = 44$, *Odont.* pp. 415, 416.

BRANDT *Bemerkungen über den innern Bau des Wuychochol*, WIEGMANN'S *Archiv für Naturgesch.* 1836, I. s. 176—182.—*Myogalea pyrenaica* GEOFFR. SAINT-HILAIRE, *Ann. du Mus.* XVII. Pl. IV. figs. 1, 3, 4, 5, *Mém. du Mus.* I. Pl. XV. figs. 10—12 (the skull and the teeth); smaller than the preceding, tail as long as the body, compressed at the tip only; this species lives at the foot of the Pyrenees. They are aquatic animals, living in holes of which the entrance is in the water.

Macroscelides SMITH, (*Macroscelis* FISCHER, *Rhinomys* LICHTENST.). Incisor teeth $\frac{6}{4}$, small, with upper middle larger; true canines none; molars $\frac{7-7}{8-8}$ or $\frac{7-7}{9-9}$, spurious $\frac{3-3}{5-5}$, not longer than incisors. Nose extended into a long slender proboscis, with nostrils in the extremity, perforated a little obliquely. Eyes moderate or somewhat large. Ears large, thinly haired. Fore feet pentadactylous, with pollex and outer toe short, raised, the hind feet much longer, with four toes equal and pollex short, raised or none. Claws short, slender, compressed, incurved, acute. Tail long (tumid below behind the base, with glandular follicles in some, or in males alone).

a) *With hind feet pentadactylous.*

Sp. *Macroscelides typicus* SMITH, *Zool. Journal*, No. XVI. *Bullet. des Sc. nat.* XVIII. 1829, Août, p. 273, *Illustr. of the Zool. of South Afr. Mamm.* Pl. 10;—*Macroscelides rupestris* SMITH, *Illustr.* l. l. Pl. 11, *Macroscelides typus* ISID. GEOFFR. ST.-HILAIRE, *Ann. des Sc. nat.* XVIII. 1829, pp. 165—173, LESSON *Cent. Zool*, Pl. 12. This and some other species live in the south of Africa. In North Africa near Oran lives another species *Macroscelides Rozeti* DUVERNOY, *Mém. de la Soc. d'Hist. nat. de Strasbourg*, I. 2, 1833, pp. 1—23, Pl. I. II.

This genus of animals recalls *Parameles* amongst the *Marsupialia*. It agrees with the *marsupials* in the imperfect ossification of the palate, which is perforated by many holes.

b) *With hind feet tetradactylous.* (Sub-genus *Petrodromus* PETERS.)

Sp. *Macroscelides tetradactylus, Petrodromus tetradactylus* PETERS, *Reise nach Mossamb., Säugth.* Tab. XX.

Sorex L. (excl. *Sorex cristatus* and *aquaticus*). Incisor teeth $\frac{6}{4}$, the two middle large, the upper incurved, having at the base posteriorly a tubercle, the lower procumbent, acuminate; true canines none; molars $\frac{6-6}{4-4}$, more seldom $\frac{5-5}{5-5}$ or $\frac{7-7}{5-5}$, con-

tiguous, the spurious shorter than incisors; the true $\frac{4-4}{3-3}$, upper with crown transverse, quadrate, last very small, lower with crown tricuspidate externally, arranged obliquely inwards and forwards. Head with nose produced, acuminate, mobile. Eyes small. Ears broad. Feet pentadactylous, cloven. Tail moderate.

The *shrews* (*mures aranei, les musaraignes*) are small animals, living in subterranean holes and in general form resembling the mice. The anterior teeth above and below are very large, and are usually the only ones regarded as incisors. GEOFFROY ST.-HILAIRE announced that the anterior small teeth, regarded as molars, are also implanted in the intermaxillary bone[1]. They have no malar bone. On each side of the body a gland is situated under the skin between the fore and hind legs, which is surrounded by a circlet of short hairs, and secretes a fluid of the odour of musk. This gland consists of tubes closely conglomerated and placed under the skin; as they approach the surface of the skin they take a straighter direction at the base of the hair-follicles and finally perforate it. See VON HASSLING *Ueber die Seitendrüsen der Spitzmäuse, Zeitschr. f. wissensch. Zool.* v. 1854, s. 29—39. In those species that live in water the ears are folded together in the water, the *antitragus* closing the external auditory passage, which is in addition guarded by the bended conch of the ear as by a second cover; the external ear is unfolded when the shrews come out of the water, just as the crown of a flower unfolds itself. See GEOFFROY SAINT-HILAIRE *Mém. sur les glandes odoriférantes des Musaraignes, Mém. du Mus.* I. 1815, pp. 299—311, Pl. 15.

Compare on this genus amongst others GEOFFR. ST.-HIL. *Ann. du Mus.* 1811, pp. 169—187, Pl. 2—4, ISID. GEOFFR. ST.-HIL., *Mém sur quelques espèces du genre Musaraigne* (also on Egyptian mummies of this genus), *Mém. du Mus.* XV. pp. 117—144, Pl. 4; DUVERNOY *Fragmens d'Hist. natur. sur les Musaraignes, Mém. de la Soc. de Strasbourg,* II. 1835, pp. 1—36, Pl. 1—3; the same, *Notices pour servir à la Monographie du genre Musaraigne,* GUÉRIN *Magas. de Zool.* 1842, pp. 38—54; NATHUSIUS *Beiträge zur Kenntniss der europ. Spitzmäuse,* WIEGMANN'S *Arch. f. Naturgesch.* 1838, pp. 19—47; DE SELYS-LONGCHAMPS *Études de Micromammalogie,* 1839, pp. 11—49; SUNDEVALL in *Kongl. Vetensk. Acad. Handl.* 1842, pp. 163—188. (The first teeth resemble those that succeed them, and in this sense the shrews have no milk-teeth; although they change these and their other teeth simultaneously (possibly more than once?) according to DUVERNOY. See *Mém. de l'Acad. des Sciences de Paris, Savants Étrangers,* Tome IX, *sur les Dents des Musaraignes,* 1844. According to OWEN *Odontogr.* p. 423, the shrews change their deciduous teeth before birth.)

a) Four small teeth in upper jaw on each side between the large incisor and the true molars, lower incisors not serrate, increased by an angle;

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[1] *Mém. du Mus.* I. p. 307; see also PETERS *Ueber die Gebissformel der Spitzmäuse, Zeitschr. für Naturgesch.* 1852, s. 220—227.

apices of teeth coloured. Feet and toes protected by rigid hair. (*Crossopus* WAGLER[1], *Hydrosorex* DUVERN.)

Sp. *Sorex fodiens* PALL., GMEL., *Sorex Daubentoni* ERXL., GEOFFR., *Sorex carinatus* HERMANN, BUFF. VIII. Pl. 11, DUVERNOY, GUÉR. *Mag. de Zool.* 1842, Pl. 51; the *water-shrew.*

b) Five intermediate teeth in upper jaw on each side; lower incisors serrate; apices of teeth coloured. (*Sorex* WAGL. in stricter sense.)

Sp. *Sorex vulgaris* (L. previously) BLASIUS and KEYSERL., *Sorex tetragonurus* HERM., *Sorex araneus* L. (not SCHREB.), SCHREB. *Säugth.* Tab. 159 B; brownish grey, below ashy white, length with tail about 4¼ inches, of which the tail makes 1¼ or 1⅓ inches, the points of the teeth blood-coloured brown. This little animal is very common with us. It is said that cats will bite it to death, but are careful not to eat it (on account of its strong smell?).

c) Three intermediate teeth on each side (or more rarely four) in upper jaw; inferior incisors quite entire; apices of teeth white (*Crocidura* WAGL.).

Sp. *Sorex araneus* SCHREB., BLAS. and KEYSERL., SCHREB. *Säugth.* Tab. 160, BUFF. VIII. Tab. 10, DUVERN. l. l. Pl. 38; varies in size, but is usually somewhat larger than *Sorex vulgaris*;—*Sorex etruscus* SAVI, *Nuovo Giornale dei Letterati*, Pisa, 1822, No. 1. c. icone, DUVERNOY, GUÉR. l. l. Pl. 54; in Italy and afterwards found in Algiers also. The smallest mammal known, scarcely more than 2⅔ inches long, of which the tail makes about 1 inch.

Solenodon BRANDT. Incisors $\frac{6}{6}$, two middle upper very large, triangular, remote by a void space from the small laterals; two middle lower small, narrow, placed between two long conical, hollowed on the inner surface by a deep groove; true canines none; molars $\frac{7-7}{7-7}$, spurious $\frac{3-3}{3-3}$, conical, true $\frac{4-4}{4-4}$, with transverse crown. Lower jaw shorter than upper. Nose elongate, forming a proboscis. Eyes minute. Ears rounded, moderate, almost naked. Feet pentadactylous, with claws curved, compressed. Tail elongate, round, somewhat naked, for the greater part scaly.

Sp. *Solenodon paradoxus* BRANDT, *Mammal. exoticor. Descriptiones et Icones*, Petropol. 1835, pp. 1—20, Tab. I.-II. (This singular animal from St. Domingo is known to me only from the figure and description just cited. It is 20½ inches long, of which the tail forms 9 inches. The teeth have some resemblance to those of the Desman, but the second grooved incisor of the lower jaw distinguishes this genus from all the others of which the dental system is known hitherto.)

[1] OKEN'S *Isis*, 1832, s. 275—282.

Gymnura HORSF., VIGORS. Incisor teeth $\frac{6}{6}$, two upper middle distant, somewhat large, with the two following on each side small; true canines none; molars $\frac{8-8}{8-8}$, spurious on each side four above and below, the first representing a canine. Muzzle produced, obtuse. Eyes small. Ears rounded, naked. Feet pentadactylous, with three middle toes longer. Long bristles, especially in the back, scattered amongst the hair. Tail somewhat long, thinly haired, scaly. (Dent. form. OWEN, i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{4-4}{4-4}$, m. $\frac{3-3}{3-3}=44$.)

Sp. *Gymnura Rafflesii* VIGORS, *Zool. Journal*, No. 10, III. pp. 246—249, Pl. 8 (copied in CUV. *R. Ani., éd. ill., Mammif.* Pl. 28, fig. 3), *Viverra gymnura* RAFFL., *Linn. Trans.* XIII. 1, p. 272; Malacca and Sumatra. This animal resembles in external form the marsupials of America. The skeleton has 15 pairs of ribs and 5 lumbar vertebræ.

Rhynchocyon PETERS. Upper incisors two, very small, remote, deciduous, lower 6; molars $\frac{7-7}{7-7}$, the first upper long, resembling a canine, the true $\frac{4-4}{3-3}$. Nose porrect, forming a very long proboscis. Ears moderate. Eyes large. Feet tetradactylous, with claws strong, the outer toe in fore feet remote, the hind feet longer. Tail long, ringed, thinly haired.

Sp. *Rhynchocyon Cirnei* PETERS, *Reise nach Mossambique, Säugth.* Tab. 21; this hitherto very rare animal has the nearest affinity with *Gymnura*, at the same time some resemblance also to *Macroscelides*.

Cladobates F. CUV., *Hylogale* TEMM., *Tupaia* RAFFL. Incisors $\frac{4}{6}$, the upper remote, the lower procumbent, with four middle longer; true canines none; molars $\frac{7-7}{7-7}$, true $\frac{4-4}{3-3}$, the lower divided by a transverse groove, cuspidate. Muzzle attenuate, produced. Ears oval, somewhat large. Feet pentadactylous. Tail long, densely clothed with hair, subdistichous.

The *Tupaias* are small lively animals, found chiefly on the Sunda Islands, and in part also in the peninsula of India, and live like squirrels (which are also called Tupaias by the Malays). They feed principally on coleopterous insects, but also on fruits. The orbit is closed behind by a bony

ring.—Compare HUSCHKE *Ueber die Zähne von Cladobates*, OKEN'S *Isis*, 1827, s. 758, 760, and for the species from the Indian Archipelago SCHLEGEL and SAL. MUELLER in *Verh. over de nat. Gesch. enz., Mamm.* pp. 159—168, Pl. 26, 27.

Sp. *Cladobates ferrugineus, Tupaia ferruginea* RAFFL., GUÉR. *Iconogr., Mammif.* Pl. 10, fig. 4; Borneo, Java, Sumatra;—*Cladobates murinus, Hylogale murina* SCHL. and MUEL. l. l. Tab. 26, fig. 5; Borneo, &c.

Hylomys SAL. MUELL. Incisors $\frac{6}{6}$, two middle upper larger, remote by a space from the lateral, molars $\frac{8-8}{8-8}$, true $\frac{4-4}{3-3}$, with several cusps. Nose produced into a mobile proboscis, subrecurved at the point, with nostrils lateral. Eyes moderate. Ears large, subnude. Hind feet longer, all pentadactylous, with three middle toes longer, with claws compressed, incurved, acute. Tail very short, thinly covered with short hair.

Sp. *Hylomys suillus* SAL. MUEL., *Verhand. over de nat. Gesch. enz., Mamm.* Tab. 26, fig. 1; (the skull and teeth Tab. 25, fig. 4—7), pp. 153, 157; a small animal, less than 6″ long from the point of the snout to the end of the tail, which is only 1½″ long; nothing is known of its mode of life, except that it feeds on insects; it was observed in Java and Sumatra at a height of 1200 to 2000 feet, and seems to be rare. The skull, with some conformity to that of the preceding genus, has, however, no bony ring at the back of the orbit.

Family XL. *Erinaceina.* Back protected by spines or rigid setæ with setæ intermixed. Feet pentadactylous, not fossorial. Tail very short, or none.

Centetes ILLIG. Teeth (38 or 40) incisors $\frac{4}{6}$ $\left(\text{or } \frac{6}{6}\right)$, canines $\frac{1-1}{1-1}$, conical, large, incurved, separated above and below from the incisors and molars by a void space, molars $\frac{6-6}{6-6}$, of which $\frac{4-4}{4-4}$ resemble true molars. Snout elongate, nose proboscidean. Ears short, rounded. Tail none. Back covered with spines and setæ intermixed. (Dent. form. i. $\frac{2-2}{3-3}$, or $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, p. $\frac{3-3}{3-3}$, m. $\frac{3-3}{3-3} = 38$, or 40.)

Sp. *Centetes setosus* DESM., *Erinaceus ecaudatus* GM., BUFF. XII. Pl. 56; *le tanrec* (the young animal is figured in GUÉR: *Mag. de Zool.* 1839, *Mammif.* Pl. 1);—*Centetes semispinosus* CUV., BUFF. *Suppl.* III. Pl. 37, GUÉR.

Iconogr., Mammif. Pl. x. fig. 2 (known in early age only). These animals resemble the hedgehog, but are not able to contract themselves into a ball.

Erinaceus L. Teeth (36), incisors $\frac{6}{2}$, upper middle distant, lower procumbent, true canines none, molars $\frac{7-7}{7-7}$, true in appearance $\frac{4-4}{3-3}$, with crown square, tuberculate. Snout produced. Ears short, or moderate. Tail short. Body densely covered above with spines, at the sides and below with bristles and hair, contractile into a ball. (Dent. form. by development i. $\frac{3-3}{3-3}$, p. $\frac{4-4}{2-2}$, m. $\frac{3-3}{3-3} = 36$, OWEN.)

Sp. *Erinaceus europæus* L., BUFF. VIII. Pl. 6, GUÉR. *Iconogr., Mammif.* Pl. 10, fig. 1; the *hedgehog, le hérisson, der Igel;* a nocturnal animal, living on mice and insects, torpid in winter. Compare J. J. WETTER *Erinacei europæi Anatome,* c. 4 tab. æn. Gottingæ, 1818, 8vo; M. SEUBERT *Symbolæ ad Erinacei europæi Anatomen;* accedunt Tab. 2 lith. Bonnæ, 1841, 4to. The rolling up is effected by a strong cuticular muscle with thick margins, which is able to enclose the body like a sac.—Compare F. HIMLY *Ueber das Zusammenkugeln des Igels,* Braunschweig, 1801, 4to.

Erinaceus auritus PALL., S. G. GMELIN *Nov. Comm. Petrop.* XIV. 1, p. 519, PALLAS, ibid. p. 573, SCHREB. *Säugth.* Tab. 163; in Southern Russia, Siberia and Tartary, at the Baikal sea, &c. A species occurring in Egypt and formerly confounded with the preceding is *Erinaceus brachydactylus* WAGN., *Erinaceus libycus* EHRENB.

Compare on the rest of the species, besides WAGNER, SUNDEVALL *Ofversigt of slägtet Erinaceus, Kongl. Akad. Vetensk. Handl.* 1841, pp. 215—239. —*Erinaceus heterodactylus* SUNDEV. from Sennaar, differs by a small rudiment of thumb on the hind feet, without claw.

With *Erinaceus* ought to be placed, though commonly referred to Centetes, the *Tendrac* of BUFFON, XII. Pl. 57, *Centetes spinosus* DESMAR., named improperly by SCHREBER and GMELIN *Erinaceus setosus.* ISID. GEOFFROY SAINT-HILAIRE forms from it his genus *Ericulus,* which in that case should be placed between *Centetes* and *Erinaceus.* With the same entire number of teeth there are $\frac{4}{4}$ incisors present. See ISID. GEOFFR. in GUÉR. *Magas. de Zool.* 1839, *Mammif.* Pl. 1—4.—W. C. L. MARTIN afterwards distinguished another genus, which he named *Echinops,* and which, if it be sufficiently distinct from *Ericulus,* would seem to have one molar less on each side in the upper and lower jaw. Sp. *Echinops Telfairi* MARTIN, *Trans. of the Zool. Soc.* II. pp. 249—256, Pl. 46. I have not myself investigated these animals.

Order IX. *Chiroptera.*

Incisor teeth various in number; canines distinct; molars uniformly enamelled, multicuspidate or furnished with crown depressed, flat. Feet pentadactylous. Bones of anterior extremities and especially of fingers (except the pollex, always unguiculate) elongate, sustaining a very large membrane, serving for flight; posterior toes short, all unguiculate. Two pectoral mammæ.

To the *chiropterous* or *wing-handed* mammals the genus *Galeopithecus* is also usually referred, and thus this order becomes an artificial union of two natural families presenting great differences. Hence we consider it more expedient to receive into this order no other animals than those which are commonly named *bats*, and which alone are, in reality, wing-handed animals (*Chiroptera*), from the elongation of four fingers of the anterior limbs; for they fly by means of the membrane attached between the expanded palm of the hands. But however well adapted for flight with the hands, these animals are still capable in some degree of seizing, in which respect they differ from birds, whose anterior limbs serve exclusively for flying. The bats are nocturnal animals[1]. Their eyes are small; their ears large. They commonly produce one or two young ones at a birth, which are of very large size in comparison with the parent. In all clavicles are present; the fore-arm does not admit of rotation. These animals have no cœcum.

On this order compare above all Geoffr. St.-Hilaire (*père*) and Temminck, whom we shall cite below. T. Bell has given a concise account of the anatomy in Todd's *Cyclop.* i. pp. 594—600, 1836.

Section I. *Insectivorous Bats.*

True molar teeth $\frac{3-3}{3-3}$, cuspidate, crown with two triangles, the apices in the upper being internal, in the lower external. Fore feet with pollex unguiculate, the rest of the digits unarmed.

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[1] Whence the appellation *Vespertilio*:

"*Lucemque perosæ*
Nocte volant, seroque trahunt a vespere nomen."
Ovid. *Metamorph.* iv. 414, 415.

Gape of mouth very large. Index with a single osseous phalanx only, or with two.

Family XLI. *Nycterina.* (Characters of the section those of the single family also.)

† *Bats with nose simple.* (*Gymnorhina* WAGNER.)

Vespertilio GEOFFR. (and *Plecotus* ejusd., spec. of *Vespertilio* L.): Incisor teeth $\frac{4}{6}$, the upper middle remote, canines $\frac{1-1}{1-1}$, simple, strong; molars $\frac{4-4}{5-5}$, $\frac{5-5}{5-5}$, $\frac{5-5}{6-6}$, or $\frac{6-6}{6-6}$. Tragus of ear elongate, erect, resembling an opercle. Tail connate with interfemoral membrane. (Three true molars above and below, the rest of the molar teeth premolars.)

LINNÆUS, in the last edition of the *Systema naturæ*, enumerated only six species in his genus *Vespertilio*, of which the last two, *V. auritus* and *murinus*, alone find a place in this genus as limited by later writers. These two were the only European species of chiropters recorded by him. DAUBENTON, however, had already discovered various new European species (*Mém. de l'Acad. des Sc.* 1759, BUFF. *Hist. nat.* VIII. pp. 126—132). Subsequent writers have added several, and the number of exotic species, to be here arranged, is very remarkable, so that now scarcely fewer than 100 species are counted in the genus. Compare on this genus: H. KUHL *Die deutschen Fledermäuse*, Hanau, 1817, 4to (printed separately from the *Annalen der Wetterau-Gesellsch.* IV.), GEOFFROY SAINT-HILAIRE *Mém. sur le genre et les espèces de Vespertilion, Ann. du Mus.* VIII. pp. 187—205, F. CUVIER *Nouv. Ann. du Mus.* I. pp. 1—21, Pl. 1, 2, TEMMINCK *Monogr. de Mammal.* II. pp. 161—262, KOLENATI *Beiträge zur Naturgesch. der Europäischen Chiroptera;* Mit 6 lithogr. Tafeln, 8vo, Dresden, 1857. For the distinguishing of the European species the accurate descriptions and the subgenera given by KEYSERLING and BLASIUS are of service.

Vesperugo BLAS. and KEYSERL. (External margin of ears produced forwards under the tragus.) Sp. *Vespertilio serotinus* DAUBENT., BUFF. VIII. Pl. 18, fig. 2, SCHREB. *Säugth.* Tab. 53; one of the most common species; the tip of the tail extends free from the membrane at the posterior extremity of the body.—*Vespertilio pipistrellus* DAUBENT., BUFF. l. l. Pl. 19, fig. 1, SCHREB. *Säugth.* Tab. 54; the smallest indigenous species; see a figure of the head in GUÉR. *Iconogr., Mamm.* Pl. 9, fig. 2;—*Vespertilio noctula* DAUBENT., *Vesp. lasiopterus* SCHREB., *Vespertilio proterus* KUHL, SCHREB. *Säugth.* Tab. 44, 58; the under surface of the wing-membrane along the arms much haired; one of the commonest species in towns and in the country; of European species this has the longest and narrowest wings, it flies very high and with great celerity, sometimes even before sunset.

Vespertilio BLAS. and KEYSERL. (External margin of ears terminating under the tragus. Molars $\frac{6-6}{6-6}$.)

Sp. *Vespertilio murinus* auctor. (not L.), *Vespertilio myotis* BECHST., BUFF. l. l. Pl. 16, SCHREB. *Säugth.* Tab. 51; the largest bat of Europe; it occurs also in the North of Africa and is entirely nocturnal. (*Vespertilio murinus* L. is, according to NILLSON, *Vesp. discolor* NATTERER, a species belonging to *Vesperugo*.)

Plecotus GEOFFR., BLAS. and KEYSERL. Ears connate above the forehead, longer than head, with external margin terminating under the tragus. Molars $\frac{5-5}{6-6}$.

Sp. *Vespertilio auritus* L., BUFF. l. l., Pl. 17, fig. 1, SCHREB. *Säugth.* Tab. 50, *Ann. du Mus.* VIII. Pl. 45 (fig. of head), Pl. 48 (fig. of skull); the *long-eared bat;* the ears 1½ inches long; common in Holland and in England.

On the other genera of BLASIUS and KEYSERLING, *Synotus, Miniopterus*, see their work *Die Wirbelthiere Europa's*, s. 17, 18, 44, 45.

Amongst the exotic species we record, on account of the red stripes in the wings along the fingers (which become pale yellow in dried specimens), *Vespertilio pictus* PALL., SEBA *Thes.* I. Tab. 56, figs. 2, 3, BUFF. X. Pl. 20, fig. 3, SCHREB. *Säugth.* Tab. 49, TEMM. *Monogr.* II. Pl. 56, figs. 1—3; from India and the Sunda Islands.

Thyroptera SPIX. (*Thyreoptera*, CANTRAINE's correction.) Ears separate, with tragus small. Molar teeth $\frac{6-6}{6-6}$, or $\frac{5-5}{6-6}$. Coriaceous orbicular disc set upon the pollex, larger in the fore feet, smaller in the hind feet. Tail with tip free, emerging beyond the intercrural membrane.

Comp. H. RASCH *Nyt Magazin for Naturvidenskab.* IV. Christiania, 1843, pp. 1—10, Tab. 1;—F. CANTRAINE, *Bullet. de l'Acad. roy. de Brux.* XII. No. 5, 1845 (with col. fig. of *Thyreoptera bicolor* CANTR.). *Hyonycteris* LICHTENST. and PETERS is not distinct from this genus. *Neue merkwürdige Säugthiere des Königl. Zool. Museums*, Berlin, 1855, 4to.

Furia F. CUV. Upper canine teeth tricuspidate, lower cylindric, with anterior and posterior basal cusp; lower incisors tridentate.

Sp. *Furia horrens* F. CUV. *Mém. du Mus.* XVI. pp. 149—155, Pl. 9; from South America.

Nycticejus RAFINESQUE. Incisor teeth in adults $\frac{2}{6}$, (in younger $\frac{4}{6}$), upper conic, resembling canines; molars $\frac{4-4}{5-5}$. (Cranium narrowed between the orbits, gibbous behind, furnished with exsert crest.)

Sp. *Vespertilio borbonicus* GEOFFR. *Ann. du Mus.* VIII. Pl. 46 (fig. of head), &c.

Dysopes ILLIG., *Molossus* GEOFFR., *Dinops* SAVI. Incisor teeth in adults $\frac{2}{4}$ or $\frac{2}{2}$, sometimes $\frac{2}{0}$ $\left(\text{in younger } \frac{4}{6}\right)$, molars $\frac{4-4}{5-5}$ or $\frac{5-5}{5-5}$. Ears broad, short, approximate or connate, with outer margin terminating in an erect lobe beyond the concha, the tragus concealed within, small. Wings narrow. Intercrural membrane truncate, short; tail free at the tip. Feet short, thick, with strong toes furnished with rigid cilia; claws incurved, compressed.

Compare GEOFFROY ST.-HILAIRE *Ann. du Mus.* VI. pp. 150—156, and TEMMINCK *Monogr. de Mammal.* I. pp. 205—240, Pl. 17—23.

Species of this genus are found in both hemispheres. To those of the Western hemisphere belong two bats, figured in BUFFON, X. Pl. 19, figs. 2, 3, which SCHREBER and GMELIN united under the name of *Vespertilio molossus*, but which are imperfectly known. Also *Molossus obscurus* GEOFFR., *Dysopes obscurus* TEMM. l. l. Pl. 22, fig. 2, GUÉRIN *Iconogr., Mamm.* Pl. 7, fig. 4 (fig. of the head, the skull and the teeth), from Brasil and Surinam, &c. and many others.—In Africa is found *Dysopes Geoffroyi* TEMM. &c. (see also the new species made known by PETERS from Mosambique); on the coast of Guinea this genus has not hitherto been observed. —In Asia *Dysopes tenuis* TEMM. l. l. Pl. 19 bis, &c.; in Europe *Dysopes Cestonii, Dinops Cestonii* SAVI, BONAP. *Fauna Italica*, XIV. (also in Africa, if it does not differ from *Dysopes Ruppellii*).

In one or two species from India the pollex of the hind feet is remote from the other toes and provided with an obtuse round nail and many bent, stiff, long hairs. On such is founded the genus *Cheiromeles* of HORSFIELD. Sp. *Cheiromeles torquatus* HORSF. *Zool. Researches*, No. VIII., *Dysopes chiropus* TEMM. l. l. Pl. 17.—*Cheiromeles caudatus* TEMM. *Monogr.* II. Pl. 66, 67; from the Sunda Islands. In these animals there is found in the axilla and on the front of the breast a glandular sac, of which the fat, brown secretion diffuses a penetrating odour. With the exception of the strong hair of the toes, these animals are covered by a nearly hairless skin.

Stenoderma GEOFFR.

A genus unknown to me; tail none, ears separate, small. Comp. DESMAR. *Dict. des Sc. nat.*, Tom. 50 (1827), pp. 489, 490, Pl. *Mammif.* 16, fig. 2.

Note.—Genera *Aëllo* and *Celæno* LEACH as doubtful are more safely omitted.

See *Trans. of the Linn. Soc.* XIII. pp. 70—72.

Diclidurus Pr. Max. Incisor teeth $\frac{2}{6}$, upper canines furnished behind with a tubercle at the base, molars $\frac{5-5}{5-5}$. In place of tail two horny capsules situated above the intercrural membrane, the anterior orbicular, the posterior subtriangular, acuminate.

Sp. *Diclidurus albus, Diclidurus Freyreissii* Max., *Abb. zur Naturg. Bras.* (Lief. I.) Tab. XVI. *Beiträge zur Naturgesch. Bras.* II. s. 239—260 (with fig. of cranium).

Urocryptus Temm. Incisors $\frac{0}{6}$, molars $\frac{5-5}{5-5}$. Ears oblong, moderate, acuminate. Tail very short, emergent at the tip above the intercrural membrane.

Sp. *Urocryptus bilineatus* Temm., in Van der Hoeven *Tijdschr.* v. 1838, p. 33, Tab. II. figs. 3, 4, *Monogr.* II. pp. 301, Pl. 6, figs. 3, 4; Surinam.

Emballonura Temm. Incisor teeth $\frac{4}{6}$, upper minute, distant, upper canines with a process at the base before and behind, molars $\frac{5-5}{5-5}$. Ears moderate, oblong, with tragus small, obtuse. Nose acuminate, somewhat prominent. Tail short, connate at the base, free at the tip.

Sp. *Emballonura monticola* Temm. in V. D. Hoeven *Tijdschr.* v. p. 25, Tab. 2, figs. 1, 2, *Monogr.* II. Pl. 61, figs. 1, 2, Java;—*Emballonura afra* Peters *Reise, Säugthiere*, Tab. XII.;—*Emballonura saxatilis* Temm., *Proboscidea saxatilis* Spix, *Vespertilio naso* Pr. Max., Brasil.

In a species from Brasil there is situated in male individuals, in the anterior margin of the wing, above the humerus, a glandular sac, which secretes a reddish, fat, odorous matter, *Emballonura canina* Temm.; see Reinhardt *Annals of nat. Hist.*, Sec. Ser. III. p. 386.—In another species a similar larger sac, furnished internally with folds, is situated (perhaps in males only) on the under surface of the wing near the ulna, which opens by a fissure on the dorsal surface. On this species is founded the genus *Saccopteryx* Illig. (*Vespertilio lepturus* Schreb. *Säugth.* Tab. 57; see F. Krauss *Archiv f. Naturgesch.* 1846, s. 178—182, Taf. VI., and by the same *Das Thierreich, Säugth.* Tab. 6, fig. 4.)

Taphozous Geoffr. Two small incisor teeth above in younger individuals, in the cartilage occupying the place of the intermaxillary bone, in adults none; molars $\frac{5-5}{5-5}$. Snout conical, with nostrils

approximate. Forehead with a rounded cavity. Ears moderate, separate. Tail short, emerging by its free tip above the intercrural membrane.

Sp. *Taphozous mauritianus* GEOFFR., GUÉRIN *Iconogr., Mammif.* Pl. 9, fig. 1 (fig. of head);—*Taphozous leucopterus* TEMM. in V. D. HOEVEN *Tijdschr.* v. p. 12, Tab. 1, fig. 7, *Monogr.* II. Pl. 60, fig. 7 (see cranium in PETERS l. l. Tab. 13, figs. 20, 21); both from Africa. Other species are from Asia, as *Taph. longimanus* HARDWICKE, *Trans. of the Linn. Soc.* XIV. 1825, p. 525, Pl. 17;—*Taphoz. saccolaimus* TEMM. l. l. &c.

Noctilio L. (*Syst. nat. ed.* XII, sp. of *Vespertilio* GM.) Incisor teeth $\frac{4}{2}$; two middle upper elongate, acuminate, the lateral small, obtuse, deciduous, lower minute, bilobed; canines large; molars $\frac{4-4}{5-5}$. Snout short, with upper lip cloven. Ears moderate, separate, lateral. Tail short, emergent by its apex above the intercrural membrane.

Sp. *Noctilio leporinus, Vespertilio leporinus* L. previously, *Noctilio americanus* ejusd., *Noctilio dorsatus* GEOFFR., SCHREB. *Säugth.* Tab. 60, PR. MAXIM. *Abbild.* Lief. IX, *Beitr. zur Naturgesch. Brasil.* II. s. 218—223, GUÉR. *Iconogr., Mammif.* Pl. 7, fig. 5 (fig. of head, mouth, skull, teeth).—*Noctilio unicolor* PR. MAXIM. belongs, according to BURMEISTER, to the same species.—These South American bats would seem, according to some, to feed on fruits, which is not probable; the Prince of NEUWIED, too, has found insects in the stomach of *Noct. dorsatus*.

Chilonycteris GRAY. Incisor teeth $\frac{4}{4}$, molars $\frac{5-5}{5-5}$. Snout truncate. Lower lip marginate. Ears narrow, erect, remote, with tragus distinct. Tail placed above the ample intercrural membrane, free at the apex.

A genus unknown to me. Comp. GRAY in *Annals of nat. Hist.* IV. 1840, p. 4, *Proceed. of the Zool. Soc.* 1843, p. 20, WAGNER *Münchn. Acad. Abhandl.* V. 1.

Mormops LEACH. Incisor teeth $\frac{4}{4}$, molars $\frac{5-5}{6-6}$. Ears large, connate, with tragus lunate. Lower lip expanded, sinuous, furnished anteriorly with a quadrangular, warty lamella.

Genus from the West Indies unknown to me; according to PETERS it belongs to the following division (*naso foliato*). See PETERS *Ueb. die Gattung Mormops, Archiv für Naturgesch.* 1856, 22te Jahrgang, Bd. 1.

s. 305—310. Comp. LEACH *Trans. of the Linn. Soc.* XIII. p. 77, Pl. 7, GRAY *Ann. of nat. Hist.* IV. pp. 3—5.

†† *Bats with nose furnished with crest or foliaceous lamellæ.* (*Histiorhina.*)

Rhinopoma GEOFFR. Incisor teeth $\frac{2}{4}$, upper small, separate; molars $\frac{4-4}{5-5}$. Forehead excavated. Nostrils operculate by a small lamina. Tail connate by its base with the intercrural membrane, produced beyond the membrane.

Sp. *Rhinopoma microphyllum* GEOFFR.; *habitat* in Egypt. I have not seen this species.

Nyctophilus LEACH. Incisor teeth $\frac{2}{4}$, molars $\frac{4-4}{4-4}$. Nose with two transverse leaves, the posterior larger. Ears very large, elongate, coalesced above the forehead. Tail of length of trunk.

Sp. *Nyctophilus Geoffroyi* LEACH[1], TEMMINCK in *Bijdragen tot de natuurkundige Wetenschappen*, VII. 1832, pp. 143—145 (with fig.), *Monogr.* II. pp. 46—48, Pl. 34.

Nycteris GEOFFR. Incisor teeth $\frac{4}{6}$, molars $\frac{4-4}{5-5}$. Forehead deeply indented by a longitudinal groove, surrounded by cutaneous folds. Ears large, not coalesced, almost always conjoined at the base by a cutaneous fold extending over the forehead. Intercrural membrane large, containing the tail terminating by a forked cartilage.

Compare GEOFFR. ST.-HILAIRE *Ann. du Mus.* XX. pp. 11—20, PETERS *Reise nach Mossamb., Säugth.* s. 44—50.—Sp. *Nycteris javanica* GEOFFR. l. l. Pl. 1;—*Nycteris Daubentonii* GEOFFR., BUFF. X. Pl. 20, figs. 1, 2 (*Vespertilio hispidus* SCHREB. Tab. 46, fig. BUFF.);—*Nycteris fuliginosa* PETERS l. l. Tab. X. &c. These animals are found in Asia and Africa. According to GEOFFR. the skin is loose, as in frogs, which, however, is by no means confirmed by PETERS; that these bats are able to inflate their skin, as G. has certified, has been contradicted by this meritorious traveller.

Rhinolophus GEOFFR. Incisor teeth $\frac{2}{4}$; or $\frac{0}{4}$, upper small, distant, in the cartilaginous intermaxillary bone. Molar teeth

[1] *The characters of seven genera of Bats with foliaceous appendages to the nose; Trans. of the Linnæan Soc.* XIII. p. 23 sqq.

$\frac{5-5}{6-6}$ $\left(\text{or } \frac{4-4}{5-5} \text{ or } \frac{5-5}{5-5}\right)$. Nose furnished with a complex membranous apparatus, a cordate or semiorbicular leaf, bilobed in front of the aperture of nostrils, a longitudinal crest along the nasal region, and a transverse, erect leaf at the posterior part, over the forehead. Ears large, separate, destitute of tragus, often operculate by a lobe at the base of external margin. Tail long, connate with intercrural membrane.

Compare GEOFFR. ST.-HILAIRE *Ann. du Mus.* XX. 1813, pp. 251—260; TEMMINCK *Monogr.* II. pp. 1—39.—This genus is altogether peculiar to the Eastern hemisphere and does not extend far towards the North, most of the species being found in warm countries. The females of the European species and also of most (though not all) of the exotic have at the posterior part of the abdomen, close to the region of the pubic bones, two short, flat, nipple-shaped appendages, of which the use is unknown. By day these animals hang clinging by their hind feet with the body rolled in the wings as in a mantle.

Two sub-genera have been distinguished.

Rhinolophus (in stricter sense). With frontal leaf erect, lanceolate. Sp. *Rhinolophus Ferrum equinum, Rhinolophus unihastatus* GEOFFR., BUFF. VIII. Pl. 20 (cop. in SCHREB. Tab. 62, upper fig.), figures of the head in DAUBENTON, BLUMENB. *Abb. Naturh. Gegenst.* No. 42, GEOFFR. l. l. Pl. V. &c.; in Southern Europe, Southern Germany, France, Italy, the Crimea;—*Rhinolophus hippocrepis, Rhinolophus bihastatus* GEOFFR., BUFF. VIII. Pl. 17, fig. 2 (SCHREB. Tab. 62, lower fig.), GEOFFR. l. c. (fig. of head); Germany, England, France, Switzerland, &c.;—*Rhinolophus capensis* LICHTENST., KRAUSS *Das Thierreich*, I. Tab. 5, fig. 8 (head);—*Rhinol. lobatus* PETERS, *Reise, Säugth.* Tab. IX. &c.

Phyllorhina BONAP., PETERS. With frontal leaf broad, depressed. (Only two phalanges in toes of hind feet, PETERS.)

Sp. *Rhinolophhus nobilis* HORSF. *Zool. Research.* Nos. 6, 7, TEMM. *Monogr.* II. Pl. 28;—*Rhinolophus (Vespertilio) speoris* SCHNEID., SCHREB. *Säugth.* Tab. 59 B, PÉRON *Voy. aux terr. Austr.* Pl. 35;—*Rhinolophus vittatus, Phyllorhina vittata,* PETERS, *Reise Säugth.* Tab. VI. &c.

Megaderma GEOFFR. Incisor teeth $\frac{0}{4}$, molars $\frac{4-4}{5-5}$. Small cartilage in place of intermaxillary bone. Nose with complex membranous apparatus. Ears very ample, coalesced, furnished with tragus. Tail none.

Compare GEOFFR. ST.-HILAIRE *Ann. du Mus.* XV. pp. 187—198, Pl. 12. This genus, like the preceding, is proper to the Eastern hemisphere.

Sp. *Megaderma frons* GEOFFR., *Dict. class. d'Hist. natur.* Livrais. XIV. No. 4, *Dict. univ. d'Hist. nat., Atlas, Mammif.* Pl. 7 A, fig. 2; the head figured

Ann. du Mus. XX. Pl. 1; in Senegal, on the coast of Guinea.—*Megaderma spasma, Vespertilio Spasma* L., *Megaderma trifolium*, GEOFFR. ST-HILAIRE, SCHREB. *Säugth.* Tab. 48; the head figured *Ann. du Mus.* XV. Pl. 12; Java.

Phyllostoma CUV., GEOFFR. Incisor teeth $\frac{4}{4}$, small, lower very small, placed in front of canines, nearly contiguous at the base; canines large; molars $\frac{5-5}{5-5}$ $\left(\text{more seldom } \frac{5-5}{6-6}, \text{ or } \frac{4-4}{5-5}\right)$. Nose with double membrane, one erect, the other subhorizontal. Ears moderate, distant, furnished with tragus small, elongate. Tail mostly short, in some none.

Compare GEOFFR. SAINT-HILAIRE *Ann. du Mus.* XV. pp. 163—187.

Sp. *Phyllostoma crenulatum* GEOFFR. l. l. Pl. 10, GUÉRIN *Iconogr., Mammif.* Pl. 8, fig. 1; with tail of which the extremity extends somewhat beyond the membrane between the hind legs.—*Phyllostoma spectrum, Vespertilio spectrum* L., SCHREB. *Säugth.* Tab. 45 (fig. from SEBA *Thes.*) without tail (*Vampirus* GEOFFR.)—The sub-genus *Arctibœus* LEACH, *Nyctiplanus* GEOFFR., is distinguished by the absence of a membrane between the hind legs.

These large bats live in South America. Their tongue is flat and elongate. They live on insects, but suck also the blood of sleeping animals, and, according to some, even of man. See PR. MAXIM. *Beitr. z. Naturgesch. Bras.* II. s. 175, 176, V. TSCHUDI *Peru, Reiseskizzen*, II. s. 244, 245.

Glossophaga GEOFFR. Incisor teeth $\frac{4}{4}$, molars $\frac{6-6}{6-6}$. Snout elongate, thin. Ears moderate, distant, furnished with small tragus. Nasal appendage double. Intercrural membrane mostly small or none; tail short or none. Tongue very long, extensile, rough with reversed papillæ.

Compare GEOFFR. SAINT-HILAIRE *Mém. du Mus.* IV. pp. 411—418, Pl. 17, 18; the species are from South America, like those of the preceding very similar genus, but smaller. Sp. *Glossophaga soricina, Vespertilio soricinus* PALL. *Spic. Zool.* III. Tab. 3, 4 (SCHREB. *Säugth.* Tab. 47);—*Glossophaga amplexicauda* GEOFFR. l. l. Tab. 18, fig. A, &c.

Brachyphylla GRAY.

Sp. *Brachyphylla badia* GRAY, *Proceed. of the Zool. Soc.* 1833, p. 123, *Annals of Nat. Hist.* IV. p. 2, Pl. 1, fig. 1; from the West Indies; a species unknown to me.

Desmodus PR. MAXIM. Incisor teeth $\frac{2}{4}$, upper large, incurved (in younger 6 small), lower small, bifid; upper canines compressed;

molars $\frac{2-2}{3-3}$, small, with crown compressed, acute. Nose with crested membranous folds. Ears moderate, acuminate, furnished with tragus. Pollex long, extended in front of alar membrane. Tail none. Intercrural membrane small. (Dent. form. OWEN, i. $\frac{1-1}{2-2}$, c. $\frac{1-1}{1-1}$, p. $\frac{2-2}{3-3} = 20$.)

A genus very distinct from all the rest of the bats by its small molars terminating in a cutting edge, from tropical America. Sp. *Desmodus rufus* MAXIM., *Abbild. z. Naturgesch. Bras.* Liefer X.; ejusd. *Beiträge*, II. s. 231—238, &c. Compare BURMEISTER *Syst. Uebers.* s. 55—57.

Note.—Genus *Diphylla* SPIX, imperfectly known, allied to *Desmodus*, is distinguished by the inferior incisors pectinate, somewhat long, the ears lunate, pollex somewhat short, and by the absence of intercrural membrane. Comp. WAGNER in SCHREBER'S *Säugth. Supplementband*, I. s. 381—383.

SECTION II. *Frugivorous Bats.*

Molar teeth with crown flat, with middle longitudinal groove. Ears small, destitute of tragus. Index with three phalanges, almost always unguiculate. Tail very short or none. Interfemoral membrane small, deeply excised posteriorly. (Head with face protracted, gape of mouth less than in the preceding.)

Family XLII. *Pterotocyna.* (Characters of the section.)

The *frugivorous* bats are, on the whole, the largest species of this order, and are found in the warm regions of the eastern hemisphere only.

Compare on this division GEOFFR. SAINT-HILAIRE, *Ann. du Mus.* XV. pp. 86—108, Pl. 4—8;—ISID. GEOFFR. SAINT-HILAIRE, article *Roussette, Dict. class. d'Hist. nat.* XIV. pp. 695—708;—TEMMINCK, *Monogr.* I. pp. 157—204, II. pp. 49—112.

Hypoderma ISID. GEOFFR., (*Cephalotes* GEOFFR. in part, *Cephalotes* TEMM.) Incisor teeth in younger $\frac{4}{4}$, in adults $\frac{2}{2}$, in aged $\frac{2}{0}$; molars $\frac{4-4}{6-6}$. Index unarmed. Tail distinct. Membrane of wings produced above the skin of back, continuous.

Sp. *Hypoderma Peronii, Cephalotes Peronii,* GEOFFR. *Ann. du Mus.* XV. Pl. 7; TEMM. *Monogr.* II. p. 106, Pl. 35, fig. 7 (fig. of head); Banda, Timor, Amboyna.

Pteropus GEOFFR., TEMM. Incisor teeth $\frac{4}{4}$. Index always unguiculate. (Dent. form. OWEN, i. $\frac{2-2}{2-2}$, c. $\frac{1-1}{1-1}$, p. $\frac{2-2}{3-3}$, m. $\frac{3-3}{3-3} = 34$.)

Macroglossus F. CUV. Molar teeth $\frac{5-5}{6-6}$. Snout elongate, thin. Tongue very long, vermiform. Rudiment of tail emerging above intercrural membrane.

Sp. *Pteropus minimus* GEOFFR., *Pteropus rostratus* HORSF., *Zool. Research.* No. 3, TEMM. *Monogr.* I. Pl. 15, figs. 25—28, Pl. 16, figs. 1, 2 (skeleton); Java, Sumatra, Celebes, &c.

Pachysoma GEOFFR. Molar teeth $\frac{4-4}{5-5}$. Snout short. Tail very short or none.

Sp. *Pteropus brevicaudatus* GEOFFR., TEMM. *Monogr.* II. Pl. 35, fig. 9 (fig. of head);—*Pteropus melanocephalus* TEMM. *Monogr.* I. Pl. 12, &c.

Pteropus (in stricter sense). Molar teeth $\frac{5-5}{6-6}$. Snout elongate.

a) *With tail short. Cynonycteris* PETERS. (Pollex involved in alar membrane.)

Sp. *Pteropus amplexicaudatus* GEOFFR., *Ann. du Mus.* XV. Pl. 7, &c.

b) *Tail none. Pteropus* PETERS. (Pollex free.)

Sp. *Pteropus edulis* GEOFFR., TEMM., *Vespertilio vampyrus* L. (in part), SEBA *Thes.* I. Tab. 57, figs. 1, 2, *Pteropus javanicus* DESM., HORSF. *Zool. Res. in Java,* No. IV. TEMM. *Monogr.* I. Pl. 15, figs. 1—6 (cranium), II. Pl. 35, fig. 1 (head); the *Kalong,* the largest of the known species; in some individuals the flight is 4′ 8″, or even 4′ 10″; the colour is brown-black with red neck, which last colour is sharply defined; this species lives in the Indian Archipelago and is common in Java; by day it hides in fig-trees especially.—*Pteropus Edwardsii* GEOFFR., CUV. *R. Ani., éd. ill., Mammif.* Pl. 23, fig. 1, *Dict. univ. d'Hist. nat., Mamm.* Pl. 7 A bis; brown-red, with brown-black back, Madagascar;—*Pteropus Dussumierii* ISID. GEOFFR., GUÉR. *Iconogr., Mammif.* Pl. 7, fig. 1; from the continent of India, &c.

Harpyia ILLIG., TEMM. (*Cephalotes* GEOFFR. ST.-HIL., in part.) Incisor teeth in adults $\frac{2}{0}$ $\left(\text{in younger } \frac{2}{2}?\right)$, molars $\frac{4-4}{5-5}$. Index unguiculate. Tail distinct. Nostrils tubular.

Sp. *Harpyia Pallasii* TEMM., *Vespertilio cephalotes* PALL., *Spic. Zool.* III. Tab. I. II., BUFF. *Suppl.* III. Pl. 52, TEMM. *Monogr.* II. Pl. 40; Amboyna; a rare species, of which a few specimens alone have been brought to Europe. The intermaxillary bones are perfect, whilst *Hypoderma*, with which this genus was formerly united, presents traces of them only, connected by cartilage. The wings, when expanded, are full 14 inches broad.

ORDER X. *Ptenopleura* s. *Dermoptera.*

Incisor teeth and molars; true canines none, their place being occupied by false molars, with root double, crown elongate, compressed. Feet pentadactylous, with fore toes not elongate, all unguiculate. Body surrounded by a hairy lateral membrane, expanded from the nape to the hands, and from the hands to the soles, connecting the hind feet, and produced behind the feet in form of a triangle as far as to the tip of the tail.

This small order contains a single genus only. From the preceding order it is very distinct, but more nearly connected with some insectivores, and most nearly of all with the first family of the succeeding order, with which it might be united, in case it should not be regarded as a distinct order. These animals have a large cœcum.

Family XLIII. *Galeopitheci.* (Characters of the order.)

Galeopithecus PALL. Incisor teeth $\frac{4}{4}$, two upper on both sides placed at the sides of the intermaxillary bone, compressed, with crown acute, separate by a wide vacant space in front, lower procumbent, with crown incised like a comb. Canines $\frac{0-0}{1-1}$, molars $\frac{6-6}{6-6}$, true $\frac{4-4}{4-4}$, with crown cuspidate. (Dent. form. OWEN, i. $\frac{2-2}{3-3}$[1], c. $\frac{1-1}{1-1}$, p. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3} = 34$.)

Sp. *Galeopithecus variegatus* GEOFFR., *Lemur volans* L., *Galeopithecus volans* PALLAS, *Act. Acad. Petrop.* 1780, I. p. 208, Tab. 8, GUÉRIN *Iconogr., Mamm.* Pl. 9, fig. 4 (4*a* the skull, 4*b* the lower incisors); the skeleton is figured in D'ALTON *Die Skelete der Chiropteren u. Insectivoren*, Tab. I. In Java,

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1 "The third incisor, viewed through the analogy of the Lemurs, seems to be a canine, but in nature its crown is in advance of the last intermaxillary tooth above," &c. OWEN *Odont.* p. 431.

Borneo and Sumatra; in the last-named island the animal is named *Koobeen* in Java *Tando*. It keeps in the depths of the lofty forests, is of a wild disposition, and seeks its food by night. The females carry about their young for a long period hanging at their belly. There is a great variety of colour in different individuals, some are light grey, or brownish grey, some are russet, some marbled with black stripes and large light-coloured round spots. (In Sumatra there lives, according to TEMMINCK, a distinct species of the last-named colour, *Galeopithecus marmoratus*, of which *Galeopithecus rufus* would seem to be the male. This naturalist adopts three species; *Coup d'œil sur les Possessions Neerlandaises*, II. p. 87. SAL. MUELLER is disposed to recognise only one species in the individuals observed by him in the Sunda Islands, *Verh. over de nat. Gesch. der Nederlandsche Bezittingen Zoologie*, p. 19.—WATERHOUSE is of opinion that the specimens from the Philippine Islands are specifically distinct. They are smaller and have larger molars. He names this species *Galeopithecus Philippinensis*, whilst he refers all the others to a single species, to which he gives the new name of *Galeopithecus Temminckii. Trans. of the Zool. Soc.* II. 1841, pp. 335—342, Pl. 58, with figures of the skulls.)

ORDER XI. *Quadrumana.*

Incisor teeth, canines and molars; molars equably enamelled. Feet unguiculate, either all pentadactylous or only the posterior, with anterior tetradactylous, pollex none. Pollex in the pentadactylous feet remote from the other fingers, with nail flat. Mammæ pectoral.

Four-handed Mammals; so named on account of the disposition of the digits in the anterior and posterior limbs.

Compare J. B. AUDEBERT *Hist. nat. des Singes et des Makis*, Paris, an. VIII. (1800) fol. with beautifully coloured figures.—GEOFFR. SAINT-HILAIRE *Tableau des Quadrumanes, Ann. du Mus.* XIX. pp. 85—122, pp. 156—170. The copious article *Quadrumana* by W. VROLIK in TODD'S *Cyclopædia*, IV. pp. 191—221, may be consulted with advantage, in which also the literature up to 1845 is noticed.

Family XLIV. *Lemurina* s. *Prosimii.* Upper incisor teeth four, mostly in pairs, approximate to the canines, separate by an intermediate edentulous space, lower four or two, very often procumbent. Both fore and hind feet pentadactylous, with fourth finger longest of all, the hind feet longer than the fore feet, with nail of second finger incurved, narrow, subulate, suberect; the other nails flat.

Compare on this family G. FISCHER *Anatomie der Maki*, I. Bd. with 24 Plates, Frankf. a. M. 1804, 4to, and my *Bijdragen tot de kennis van de*

Lemuridæ of Prosimii, Tijdschr. voor nat. Gesch. XI. 1844, pp. 1—48, Pl. 1—3 (also printed separately, fol.)

The lemurs or spectre-animals, *makis* (a small family of which more than 30 species are now known), belong chiefly to Madagascar as their home; a few species live on the continent of Africa, others in the warm regions of Asia and in the Indian Archipelago. These animals are distinguished from the monkeys and further removed from man by the two-horned *uterus*, by the lower jaw remaining permanently divided in the middle, and by the orbits open behind and not separated from the temporal fossæ by the great alæ of the sphenoïd bone. There is, however, a bony ring separating the orbits from the temporal fossæ, and formed by the junction of a process of the frontal with the malar bone, a disposition not present in *Galeopithecus*. LINNÆUS united the species known to him with *Galeopithecus* in his genus *Lemur*.

Phalanx I. *Nail of the index alone of the soles incurved, subulate. Upper incisor teeth four, in pairs.*

A. *With tarsus not elongate.*

Lichanotus ILLIG., *Indris* GEOFFR. Incisor teeth $\frac{4}{2}$, canines $\frac{1-1}{1-1}$, molars $\frac{5-5}{5-5}$. Ears small, rounded. Hind feet elongate. Dent. form. OWEN, i. $\frac{2-2}{1-1}$, c. $\frac{1-1}{1-1}$, p. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3} = 30$.)

Sp. *Lichanotus brevicaudatus, Lemur Indri* GM., *Indri* SONNERAT, *Voy. aux Ind. Or.* Pl. 36, AUDEB. *Makis*, pp. 7—9, Pl. 1, GUÉR. *Iconogr., Mammif.* Pl. 5, fig. 3, V. D. HOEVEN *Tijdschr.* XI. Pl. 1. fig. 5 (skull); a very short tail; chief colour black, throat, buttocks and heels, white. Madagascar.

Lichanotus Avahi mihi, *Indris longicaudatus* GEOFFR., *Lemur laniger* GMEL., *Maquis à bourres* SONNER. l. l. Pl. 67, BUFF. *Suppl.* VII. Pl. 35, V. D. HOEVEN *Tijdsch.* XI. Pl. III. (the skull, Pl. 1, fig. 6); a long tail, the fur woolly, chief colour brown, with a more ruddy tint over the legs and on the tail, the belly grey; in the eastern parts of Madagascar. By its long tail it is distinguished from the preceding, which is very different in *habitus;* on it is founded the genus *Habrocebus* WAGN.

Propithecus BENNETT.

Note.—Genus unknown to me, with upper incisors expanded towards the crown, approximate. See *Proceed. of the Zool. Soc.* 1832, pp. 20—22. Sp. *Propithecus diadema* BENN., *Habrocebus diadema* WAGN. Habit. in the island of Madagascar. See the skull of a younger specimen figured in BLAINVILLE *Osteographie*, III. Pl. 8; fig. of teeth, *ibid.* Pl. II. BLAINVILLE

asserts that the skull scarcely differs from that of *Lichanotus Indris* of the same age.

Stenops ILLIG. (genera *Loris* and *Nycticebus* GEOFFR.) Incisor teeth $\frac{4}{4}$, canines $\frac{1-1}{1-1}$, molars $\frac{6-6}{6-6}$. Ears short, rounded. Eyes large, approximate. Index of hand short, not longer than pollex. Tail short or none.

The teeth of this genus are 36 in number, and agree as well in this respect as in their arrangement with those of the genera *Lemur* and *Otolicnus*.—Formerly the six anterior teeth placed horizontally in the lower jaw were regarded as incisors, and LINNÆUS gave as a character of his genus *Lemur*, "*dentes primores inferiores* sex." Of these six teeth the four middle ones are very thin; the most external on each side is conspicuously thicker. This is now regarded as the inferior canine, since the canine of the upper jaw (about which there can be no doubt, since the intermaxillary suture is seen in front of it), when the mouth is closed, is placed behind this outermost, just as in monkeys and carnivores. Consequently the tooth, which was commonly regarded as the canine of the lower jaw, is now indicated as the first false molar.

a) *Tail short. Index of hand very short, resembling an unarmed tubercle.* (*Perodicticus* BENNETT.)

Sp. *Stenops potto, Lemur potto* GM., *Nycticebus potto* GEOFFR. *Ann. du Mus.* XIX. p. 165, *Perodicticus Geoffroyi* BENN., *Potto* BOSMAN, *Beschrijving van de Guinese Goudkust*, 1737, 4to, pp. 30, 31, fig. 4 (opposite p. 29), BENNETT *Proceed of the Zool. Soc.* 1830, 1831, Part I. pp. 109—111; V. D. HOEVEN *Tijdschr.* XI. bl. 20—27, Pl. II. (figure of a young individual; its skull is figured *ib.* Pl. I. fig. 3); *Verhand. der eerste Klasse van het Kon. Ned. Instit.* 3e Reeks, IV. 1851, (with 2 plates, figure of the adult animal, of the skeleton, the teeth, &c.). The *Aposo* or *Aposou* of the negroes on the Gold coast of Guinea is a nocturnal animal which keeps on trees and lives on fruits. The spinous processes of the last five cervical and of the first two dorsal vertebræ are long and pierce through the hairy integument of the back, with a weak, horny covering. Prof. HALBERTSMA first drew my attention to this peculiarity, which I have observed in two specimens.

b) *Tail very short* (*Nycticebus* GEOFFR.).

Sp. *Stenops tardigradus* auct., *Lemur tardigradus* L. (in part), VOSMAER *Beschr. van eene tot nu toe onbekende vijfvingerige luijaardsoort*, Amsterdam, 1770 (with fig.), BUFF. *Suppl.* VII. Pl. 36, AUDEB. *Loris*, Pl. 1, GUÉR. *Iconogr., Mammif.* Pl. 6, fig. 3; yellowish-grey, with black stripe along the middle of back, a narrow whitish stripe between the eyes, 4 incisors above; Bengal, Siam, Sumatra, Borneo;—*Stenops javanicus* nob., *Nycticebus javanicus* GEOFFR.; very similar to the preceding, but with only 2 incisors in the upper jaw and more white between and above the eyes.

Compare on these two species my remarks in *Tijdschr. voor nat. Gesch.* VIII. 1841, bl. 337—348, with figures.

†† See for the anatomy SCHROEDER VAN DER KOLK, *ibid.* bl. 277 and foll., and W. VROLIK *Nieuwe Verhand. der eerste Klasse van het Koninkl. Nederl. Instit.* X. 1843.

c) *Tail none* (*Loris* GEOFFR. Body slender; eyes very large, almost contiguous. Nose acute, sub-ascending).

Sp. *Stenops gracilis*, *Loris gracilis* GEOFFR., *Lemur tardigradus* L. (*Mus. Ad. Frid.* 1754, *Lemur* "*cauda omnino nulla*," p. 4), BUFF. XIII. Pl. 30, AUDEB. *Loris*, Pl. 2; in the island of Ceylon, smaller than the preceding species. On the vascular plexuses of the limbs in this genus see above, p. 586. Under the tongue in this genus and the following is situated an aponeurotic lamina, which is divided at its anterior, thinner end, into filaments or slips. This arrangement (a development of the frenum of the tongue) has been described, incorrectly in my judgment, as though the tongue were double, or even as if a bird's tongue were present under the mammalian tongue.

Lemur L. (excl. of *Lemur tardigradus* and *Lemur volans*). Teeth as in the preceding genus. Snout produced. Eyes lateral. Ears short. Index of hand longer than thumb. Tail very long, hairy throughout.

Sp. *Lemur Catta* L., BUFF. XIII. Pl. 22, AUDEB. *Makis*, Pl. 4, *Mém. du Mus.* II. pp. 15 seq. (with an excellent figure), *Dict. univ. d'Hist. nat., Mammif.* Pl. 6 B, fig. 2; grey, ruddy on the back, white below; the tail ringed white and black.—*Lemur Macaco* L., *Lemur niger* GEOFFR., EDWARDS'S *Gleanings*, Tab. 217 (fig. copied in SCHREB. Tab. 40 A), variegated: *Lemur Macaco* auctor., BUFF. XIII. Pl. 27, AUDEB. *Makis*, Pl. 5, 6;—*Lemur Mongoz* L., BUFF. XIII. Pl. 27, (cop. in SCHREB. 39 A); —To these species, known to LINNÆUS, various others have been since added: *Lemur albifrons* GEOFFR., AUDEB. *Makis*, Pl. 3, GUER. *Traité élém. d'Hist. nat., Zool.* Pl. 2, fig. 3, &c. All the species are from the island of Madagascar.

Chirogaleus GEOFFR. (A scarcely distinct genus, with head shorter, the interorbital space and ridge of nose convex.)

Sp. *Lemur griscus* GEOFFR., BUFF. *Suppl.* VII. Pl. 34, AUDEB. *Makis*, Pl. 7; —*Chirog. Milii* GEOFFR., *Myspithecus typus* CUV. *Mammif.* ed. 4to, Pl. 83. The figures of COMMERSON (*Ann. du Mus.* XIX. Pl. 10), on which GEOFFR. (*ibid.* pp. 171—175) originally founded this genus, cannot be referred to these species, which were discovered later.

B. *With tarsus elongate.*

Otolicnus ILLIG., *Galago* GEOFFR. (Teeth 36, as in *Lemur*). Eyes large. Ears large, naked. Tail long (mostly longer than body), villous.

Sp. *Otolicnus galago* WAGN., *Galago senegalensis* GEOFFR. SAINT-HILAIRE, *Magasin encyclopédique*, I. 1796, p. 20, Pl. 1 (fig. cop. in SCHREB. *Säugth.* Tab. 38 B), AUDEB. *Galago*, Pl. 1. GUÉRIN *Iconogr., Mammif.* Pl. 6, fig. 2, CUVIER *R. Ani., éd. ill., Mammif.* Pl. 21, fig. 2, (under the wrong name of *Lemur potto* GM.); chief colour grey, passing into pale yellow on the legs, tail brown. Dispersed through great part of Africa, Senegal, Sennaar (RUEPPELL), Mosambique (PETERS), Kafferland (SMITH *Otolicnus Moholi*).—*Otolicnus crassicaudatus* WAGN., *Galago crassicaudatus* GEOFFR. SAINT-HILAIRE, *Grand Galago* CUV. *R. Ani.* I. 1817, Pl. 1, fig. 1, PETERS *Mossamb., Säugth.* Tab. II.; of the size of a rabbit; in the south-eastern part of Africa. These animals feed on fruits and insects; in a small species from the coast of Guinea, *Otolicnus Peli* TEMM. (*Esquisses Zool.* p. 45), nothing was found in the stomach but remains of insects. On the anatomy of this little Galago compare the Academical Essay of Dr P. HOECKEMA KINGMA *Eenige ontleedkundige Aanteekiningen over den Otolicnus Peli.* Leiden, 1855, 8vo, with a plate.

Microcebus GEOFFR., WAGN., PETERS. (Small species differing from *Otolicnus* in having the ears more hairy, facial whiskers, and upper incisors broader.)

Sp. *Otolicnus pusillus, Galago Madagascariensis* GEOFF., *Microcebus murinus* WAGN., *Rat de Madagascar*, BUFF. *Suppl.* III. Pl. 20, AUDEB. *Makis*, Pl. 8; —*Microcebus myoxinus* PET. l. l. Tab. III.; both species from Madagascar.

Phalanx II. *Nails of second and third fingers of soles incurved, subulate, sub-erect. Upper incisor teeth contiguous.*

Tarsius STORR. Incisor teeth $\frac{4}{2}$, subulate, middle upper longer than external, lower oblique; canines $\frac{1-1}{1-1}$, molars $\frac{6-6}{6-6}$, false $\frac{3-3}{3-3}$, conic, the true molars with several acute conical tubercles. Eyes very large. Ears ample, somewhat naked. Hind feet very long, with tarsus elongate. Tail much longer than body, tufted at the tip.

Sp. *Tarsius spectrum* GEOFFR., *Lemur spectrum* PALL. (Glir.); *le tarsier* BUFFON, XIII. Pl. 9, B. S. NAU, *Naturforscher*, XXV. 1791, Tab. I., AUDEB. *Makis, le Tarsier*, fig. 1, GUÉRIN *Iconogr., Mammif.* Pl. 6, fig. 4; grey-brown; this remarkable little animal lives in forests, leaps like a frog, and is found at Celebes, Borneo, Banca, &c. and also at the Philippine Islands. The various species which have been proposed for adoption are not sufficiently distinct. On the anatomy BURMEISTER has made important contributions in his interesting Monograph: *Beiträge zur nähern Kenntniss der Gattung Tarsius.* Mit 7 Tafeln. Berlin, 1846, 4to.

Family XLV. *Simiæ.* Incisor teeth four in both jaws, approximate; canines distinct, conic, longer than incisors, upper

remote from incisors; molars equably enamelled, triturators, $\frac{5-5}{5-5}$ or $\frac{6-6}{6-6}$. Face denuded. Fore feet often longer than hind feet. Third (or middle) finger both of fore and hind feet longest of all.

The monkeys form with LINNÆUS a single genus only, *Simia* (in the 12th edition of the *Syst. nat.* with 33 species). Modern writers have here adopted many genera, whilst the number of species has increased to about 180. Three large genera may be distinguished, which many now regard as separate families.

† Spurious molars $\frac{3-3}{3-3}$.

Phalanx I. *Hemipitheci.* Feet pentadactylous, with thumb of palms not remote from the other fingers. Nails incurved, compressed, acute, except that of thumb of soles, which is flat, broad. Molar teeth $\frac{5-5}{5-5}$.

Hapale ILLIG. (*Jacchus*, *Midas* GEOFFR.). False molars with outer margin unicuspidate, true with outer margin bicuspidate, the upper with crown broader than long, the last in both jaws smaller. Face obtuse; nostrils severed by a broad septum, opening laterally: Tail long, villous.

* *With lower incisors long, narrow, convex outwards.* (*Jacchus* GEOFFR.)

Sp. *Hapale Jacchus, Simia Jacchus* L., BUFF. XV. Pl. 14 (cop. in SCHREB. Tab. 33), AUDEB. *Singes*, Fam. 6, Sect. 2, Pl. 4, *ouistiti;* grey with black ringed tail and white tufts at the ears;—*Hapale penicillata, Jacchus penicillatus* GEOFFR., CUV. *R. Ani., éd. ill., Mammif.* Pl. 19, fig. 1, &c.

** *With lower incisors short, broad.* (*Midas* GEOFFR.)

Sp. *Hapale œdipus, Simia Œdipus* L., BUFF. XV. Pl. 17, *Pinche*, SCHREB. *Säugth.* Tab. 34 (fig. of EDWARDS), AUDEB. l. l. Pl. 1; grey-brown, white below, tail ruddy; long white hair on the head and neck;—*Hapale rosalia, Simia Rosalia* L., BUFF. XV. Pl. 16, AUDEB. l. l. Pl. 3; light russet-coloured, the tail often browner;—*Hapale midas, Simia Midas* L., *Midas rufimanus* GEOFFR., BUFF. XV. Pl. 13, AUDEB. l. l. Pl. 5; dark brown, with yellow-russet hands; in Guiana and Surinam. The rest of the received species are from Brasil; some occur also in Peru.

These small monkeys live together in the great forests of South America in numerous troops; they feed on insects and fruits, and jump about on the trees like squirrels.—The skeleton, in most of the species, presents twelve dorsal and seven lumbar vertebræ; the caudal vertebræ are from 26 to 31. The frontal bone in many extends between the orbits above the nasal bones and is convex at that part.

Phalanx II. *Hesperopitheci.* Nails rounded, truncate or obtuse anteriorly. Fore feet in some tetradactylous, in some penta-

dactylous, with pollex distinct, somewhat short, little separate from the other fingers. Molar teeth $\frac{6-6}{6-6}$, with four obtuse tubercles. Nostrils severed by a broad septum, patulous laterally.

These monkeys (the genus *Cebus* ERXL.) are, like the preceding, exclusively proper to America. From the form and position of their nostrils, GEOFFROY gave them the name of *Platyrhini*. The anterior limbs have a thumb only slightly distinct from the other fingers, whence OGILBY proposes to name these monkeys *pedimana*[1]. All of them have a tail, but, like the preceding division, have no buccal pouches, which occur in the monkeys of the old world alone. They are on the whole small in comparison with the monkeys of the old world, and have small molars[2].

† *Tail lax, villous, not prehensile.*

Pithecia DESM., ILLIG. Incisor teeth somewhat prominent obliquely, the lower long, canines large, thick, conic, molars small. Tail very villous.

a) *Tail long, equalling body.* Sp. *Pithecia leucocephala* AUDEB., *Simia pithecia* L., *Pithecia chrysocephala* ISID. GEOFFR., BUFF. XV. Pl. 12 (cop. in SCHREB. *Säugth.* Tab. 32), *Archives du Mus.* V. Pl. 29; the young animal has the points of the hair yellow; it is the *Pithecia rufiventer* GEOFFR., BUFF. *Suppl.* VII. Pl. 30, 31, GUÉR. *Iconogr., Mammif.* Pl. 4, fig. 3, Guiana;—*Pithecia hirsuta* SPIX (and *P. inusta* ejusd) Brasil;—*Pithecia satanas* HOFFMANNSEGG, CUV. *R. Ani., éd. ill, Mammif.* Pl. 18, fig. 1.

b) *Tail much shorter than body* (*Brachyurus* SPIX in part). Sp. *Pithecia melanocephala, Simia melanocephala,* HUMB. *Recueil d'Observ. de Zool.* I. Pl. 29.

Nyctipithecus SPIX, (*Nocthora* F. CUV., *Aotus* ILLIG.). Two middle upper incisors broad, lower obliquely procumbent; canines moderate. Eyes large. Ears partly hidden amongst the hair of head. Hind feet longer than fore feet. Tail longer than body. (Orbits very large. Zygomatic bones inflated behind the orbits.)

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[1] *Observations on the opposable power of the thumb, considered as a zoological character,* LOUDON'S *Magazine of Nat. Hist.* I. 1837, p. 49 seq.

[2] Figures of the skulls of *Lagothrix, Pithecia, Chrysothrix* and *Callithrix* have been given by WAGNER in *Abh. der Münchn. Akadem., mathem. physik. Klasse* II. Tab. II. s. 510.

Sp. *Nyctipithecus trivirgatus, Aotus trivirgatus* HUMB. l. l. Pl. 28, CUV. *R. Ani., éd. ill., Mammif.* Pl. 18, fig. 2;—*Nyctipithecus felinus* SPIX, GEOFFR. *et* CUV. *Mammif.* Livrais. 43, GUÉR. *Iconogr., Mammif.* Pl. 5, fig. 1; *douroucouli;* grey-brown, ruddy below; white above the eyes and a large black spot on the forehead. These animals sleep by day, live in pairs, and eat not fruits only, but hunt also for insects and small birds. They represent the Lemurs in South Africa. Very similar is *Nyctipithecus lemurinus* ISID. GEOFFR., *Archives du Mus.* IV. Pl. 2, the same species, according to WAGNER, as *Nyctip. vociferans* SPIX[1].

Callithrix GEOFFR. Incisor teeth straight. Eyes moderate. Tail slender, round.

Callithrix (in stricter sense). Two middle upper incisors broad. Canines short, scarcely longer than incisors. (Lower jaw high.)

Sp. *Callithrix personata* GEOFFR., *Simia personata* HUMB., PRINC. MAX. *Abb. zur Naturgesch. Bras.* Lief. 2, SCHREB. *Säugth.* Tab. 30 A;—*Callithrix melanochir* PR. MAX. Lief. 4, &c.

Chrysothrix KAUP. Canine teeth large; first molar tooth larger than rest, conic, with accessory internal basal tubercle.

Sp. *Callithrix sciurea, Simia sciurea* L., BUFF. XV. Pl. 10, SCHREB. *Säugth.* Tab. 30, CUV. *R. Ani., éd. ill., Mammif.* Pl. 17, fig. 3; the *Saimiri,* greyish-ruddy; legs yellowish, tip of tail black.

†† *Tail prehensile.* (*Last caudal vertebræ dilated.*)

Cebus GEOFFR. Head rounded. Feet congruous. Tail long, hairy throughout.

Sp. *Cebus fatuellus* ERXL., *Simia Fatuellus* L. and *Simia Apella* ejusd. (the young animal), BUFF. *Suppl.* VII. Pl. 29, AUDEB. *Singes,* V. 2, Pl. 1; the young animal figured by LINNÆUS, *Mus. Ad. Frid.* Tab. 1, BUFF. XV. Pl. 4, AUDEB. l. l. Pl. 2, GUÉR. *Iconogr., Mammif.* Pl. 4, fig. 2; brown, the legs and tail black; the old animal with the hair in two distant tufts on each side at the top of the head; five lumbar vertebræ;—*Cebus capucinus* ERXL., *Simia capucina* L., *Mus. Ad. Frid.* Tab. II. BUFF. XV. Pl. 8, AUDEB. l. l. Pl. 4; smaller, brown; face and throat greyish-yellow; head black above; six lumbar vertebræ, &c.

Compare on this genus BURMEISTER *Abhandl. d. Nat. Gesellsch. zu Halle,* II. 1854, s. 81—124.

Ateles GEOFFR., ILLIG. (more correctly *Atelochirus*). Head rounded. Extremities slender, very long; fore feet with thumb none or very short. Tail towards the tip naked below.

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[1] The skeleton of one of these species (*Nyctip. felinus*) is figured in J. GISTL *Beschreibung des Sketes des dreistreifigen Nachtäffers,* Leipzig, 1836, 8vo, and by WAGNER *Abhand. der Münchn. Akadem., math.* I. *physik. Klasse* II. s. 420—432, Tab. I.

Compare GEOFFR. SAINT-HILAIRE *Mém. sur les singes à main imparfaite, Ann. du Mus.* VII. pp. 260—273. (The last species noticed there, *Ateles polycomos*, is from the Eastern hemisphere, and belongs to *Colobus* ILLIG.)

Sub-genus *Eriodes* ISID. GEOFFR. (With fur woolly.)

Sp. *Ateles hypoxanthus* PR. MAXIM., *Abb. zur Naturgesch. Bras.* Lief. I. GUÉR. *Iconogr., Mammif.* Pl. 4, fig. 1 (*Brachytcles?* SPIX), with a very short thumb on the anterior limbs, without nail. (*Eriodes hemidactylus* ISID. GEOFFR., *Mém. du Mus.* XVII. Pl. 22, differs by having a nail on this thumb, but is, according to WAGNER, of the same species.)—The fore feet have, on the contrary, only four fingers in *Ateles arachnoides* GEOFFR., *Ann. du Mus.* XIII. Pl. 9, although in the skeleton one *phalanx* is attached to the metacarpal bone of the thumb (WAGNER *Supplementband*, 5te Abth. s. 81).

Sub-genus *Ateles* (in stricter sense, with long, rigid hair).

Sp. *Ateles paniscus, Simia Paniscus* L., BUFF. XV. Pl. 1, AUDEB. *Singes*, V. 1, Pl. 2; VOSMAER *Beschrijving van eene Amerikaansche langstaartige aapsoort*, Amsterdam, 1768, 4to; the *coaita*, dark black, the face red; fore feet without thumb; the skeleton is figured in PANDER *und* D'ALTON *Die Skelete der Vierhänder*, Tab. II.; Surinam, Brasil. In a very similar species a short thumb occurs: *Ateles pentadactylus* GEOFFR., *Ateles belzebut* GEOFFR., *Cercopithecus belzebut* BRISS., GEOFFR. *Ann. du Mus.* VII. Pl. 16, &c.

Lagothrix GEOFFR., *Gastrimargus* SPIX. Head rounded, beardless. Feet very long, fore feet pentadactylous. Fur soft. Tail with tip naked below.

Sp. *Lagothrix cana* GEOFFR., *Gastrimargus olivaceus* SPIX, SCHREB. *Säugth.* Tab. 26 F;—*Lagothrix infumata, Gastrimargus infumatus* SPIX, CUV. *R. Ani., éd. ill., Mammif.* Pl. 16, fig. 4. (This genus differs little from the preceding.)

Mycetes ILLIG., *Stentor* GEOFFR. Head pyramidal, bearded. Fore feet pentadactylous. Tail naked below at the apical part. (Lower jaw very high; hyoïd bone expanded into an ample, resonant bulla.)

Sp. *Mycetes seniculus, Simia Seniculus* L., BUFF. VII. Pl. 25, AUDEB. *Singes*, V. 1, Pl. 7, GUÉR. *Iconogr., Mammif.* Pl. 3, fig. 3; the *howling monkey, l'Alouatte, le hurleur roux, der Brüllaffe;* South America, Surinam, Brasil. (WAGNER is of opinion that *Mycetes ursinus* HUMB. *Recueil*, I. Pl. 30, and *Stentor chrysurus* GEOFFR. may be referred to this same species.)—*Mycetes Beelzebut, Mycetes rufimanus* KUHL, &c. Compare on this genus ISID. GEOFFR., GUÉRIN *Magas. de Zool.* 1831; GRAY *Ann. of nat. Hist.* XVI. pp. 217—221.

†† Spurious molars $\frac{2-2}{2-2}$.

Phalanx III. *Heopitheci.* Nails flat or subrotund, obtuse at the apex. Fore feet pentadactylous, with thumb remote, very rarely tetradactylous without thumb. Molar teeth $\frac{5-5}{5-5}$, false molars tuberculate. Nostrils severed by a small, narrow septum, opening obliquely under the nose. (Tail never prehensile, sometimes none. Region at the tubers of ischium almost always destitute of hair, callous.)

A. *Buccal pouches. Nates callous.*

Cynocephalus Cuv. Last molar tooth of lower jaw with one or two accessory tubercles; the two other true molars quadrituberculate. Face produced into a truncate snout. Eyes small, approximate, placed beneath the transverse ridge of the exsert margin of frontal bone. Trunk declining backwards. Tail very short or moderate, inserted high, with tip often tufted.

a) With tail very short (*Papio* Briss., Erxl., *Mormon*).

Sp. *Cynocephalus maimon, Simia Maimon* L. (and *Simia mormon* Allström., Gm.) Buff. *Suppl.* vii. Pl. 9, Audeb. *Singes,* ii. 2, Pl. 1, Cuv. *Ménag. du Mus.* i. pp. 334—345, Guér. *Iconogr., Mammif.* Pl. 3, fig. 2; the *mandril;* a large, brownish-black monkey, the belly dirty-white, a yellow beard, the nose in the adult red and the face on each side purple-blue, with deep, longitudinal folds; in Africa at the Gold Coast.—*Cynocephalus leucophœus* Desm., *Simia leucophœa* Cuv., *Ann. du Mus.* ix. p. 477, Pl. 37, *Mammif.* (ed. 4to), Pl. 48—52.

b) With tail moderate, tufted at the tip (*Cynocephalus* in stricter sense).

Sp. *Cynocephalus sphinx, Simia Sphinx* L., Buff. xiv. Pl. 13, 14 (with tail truncated), Audeb. *Singes,* iii. Pl. 1, 2, *Cynocephalus papio* Cuv. *Mammif.* (ed. 4to), Pl. 44, 45; coast of Guinea, Senegal. A similarly formed, but more darkly coloured monkey represents this species in South Africa: *Cynocephalus porcarius, Simia porcaria* Boddaert, *Naturforscher* xxii. Tab. 1, Guér. *Iconogr., Mammif.* Pl. 3, fig. 1; it is the black ape of the colonists.—*Cynocephalus papio* (*Cynocephalus babuin* Desm.) Cuv. *Mém. du Mus.* iv. Pl. 19;—*Cynocephalus hamadryas, Simia hamadryas* L., Büff. *Suppl.* vii. Pl. 10, Schreb. *Säugth.* Tab. 10, 10*, Cuv. *Mammif.* (ed. 4to), Pl. 46; these two last-named species live in Abyssinia; the last is the monkey, sacred to the god *Thoth,* of the Egyptians, so often represented on their monuments; see Ehrenberg *Ueber den Cynocephalus,* &c. Berlin, 1834, 4to.

In Asia also some species of this genus occur, *Cynocephalus niger* Desm. and *Papio nigrescens* Temm., both from Celebes, and the (formerly referred to *Macacus*) *Cynocephalus silenus, Simia Silenus* L., Buff. xiv. Pl. 18, *Zool. Gardens,* i. p. 21, Cuv. *Mammif.* ed. 4to, Pl. 38; this monkey has been

incorrectly named *Wanderoe*, a name which belongs to a species of monkey in Ceylon, whilst this species lives only on the continent of India, although often imported into Ceylon from the coast of Malabar; KEELAART *Prodromus Faunæ Zeylanicæ*, Ceylon, 1851, 8vo, p. 8.

Inuus CUV., WAGN. (and *Macacus* CUV.). Last molar tooth of lower jaw quinquetuberculate, the two other true molars quadrituberculate. Face produced, rounded. Eyes placed under the shade of the exsert margin of frontal bone. Tail of different length in different species, with tip not tufted.

This genus is not sharply distinguished from the following, except by the last molar of the lower jaw. Hence all the long-tailed species in which this character is present ought to be removed from *Cercopithecus* and placed here, if it be the object to form an exact representation of this genus[1]. In the most the tail is moderate. *Inuus nemestrinus, Simia Nemestrina* L., BUFF. XIV. Pl. 19; AUDEB. *Singes*, II. 1, Pl. 2, GUÉR. *Iconogr., Mammif.* Pl. 2, fig. 2, Sumatra; this species is trained by the aborigines to pluck cocoa-nuts.—In one species there is only a little short tubercle present as indication of tail: *Inuus ecaudatus* GEOFFR., *Simia Inuus* L. (and *Simia Sylvanus* ejusd.), BUFF. XIV. Pl. 8, 9, *Suppl.* VII. Pl. 2, 3, GUÉR. *Iconogr., Mamm.* Pl. 2, fig. 3; the face dirty flesh-coloured, the hair yellowish-grey. This monkey lives in North Africa and also wild upon the rock of Gibraltar. It was this species (and by no means the orang) which GALENUS dissected. Compare on this species F. W. THEILE *Ueber das Arterien-System von Simia Inuus*, MUELLER'S *Archiv*, 1852, s. 419—449, Tab. XI.

Cercopithecus ERXL. Last molar tooth of lower jaw with four tubercles. Face produced, rounded. Eyes somewhat prominent. Tail equalling body or longer than body.

A numerous genus of monkeys, proper to Africa. Sp. *Cercopithecus sabæus* F. CUV., *Cercopithecus callitrichus* ISID. GEOFFR., BUFF. XIV. Pl. 37, AUDEB. *Singes*, IV. 2, Pl. 4, CUV. *Ménag. du Mus.* II. pp. 9—14; back greyish-yellow, belly whitish; the face black, the tip of the tail russety; on the coast of Guinea, in Senegal;—*Cercopithecus griseus* F. CUV., *Cercopithecus sabæus* ISID. GEOFFR., F. CUV. *Mamm.* (ed. 4to), Pl. 20, *Dict. univ. d'Hist. nat., Mammif.* Pl. 6; Nubia, Abyssinia; much resembling the preceding, with grey tail; according to ISID. GEOFFROY this species is indicated by LINNÆUS in his *Simia sabæa*;—*Cercopithecus Diana* DESM. (in part), *Simia Diana* L., SCHREB. *Säugth.* Tab. 14, AUDEB. *Singes*, IV. 2, Pl. 6; from the coast of Guinea; the fur is used for many purposes by the negroes, and is often also brought to Europe.—

[1] The *Cercopithecus æthiops* and *Cercop. fuliginosus*, which LINNÆUS confounded with his *Simia æthiops*.

Cercopithecus leucampyx FISCH., *Cercopithecus Pluto* GRAY, *Zool. Proceed.* 1848, *Mamm.* Pl. 3, *Cercopithecus Diana* F. CUV., *Mammif.* (ed. 4to), Pl. 14, &c.

B. *Buccal pouches none.*

† *Buttocks callous.*

Semnopithecus F. CUV. (and *Colobus* ILLIG.). Buccal folds, rudiments of pouches. Face little produced. Last molar tooth of lower jaw mostly with a fifth accessory tubercle behind. Feet long, fore feet with thumb very short, in some none, with third and fourth fingers long, subequal. Tail long, equalling body or mostly far surpassing it.

Colobus ILLIG. Fore feet tetradactylous, with a tubercle in place of thumb, or thumb none.

Sp. *Semnopithecus polycomos, Simia polycomos* ZIMMERM., *Colobus polycomos* WAGN., PENNANT *Quadr.* Pl. 46 (fig. cop. in BUFF. *Suppl.* VII. Pl. 17, SCHREBER *Säugth.* Tab. 10 D), *Colob. ursinus* OGILBY, FRASER *Zool. typ.* Tab. 1, *Colobus vellerosus* ISID. GEOFFR., *Colobus leucomeros* OGILBY; the *baardmannetje* (*bearded manikin*) of BOSMAN; this monkey becomes 2 feet long, the tail 2 feet 8 inches; black, the tail white; the adult animal, especially the male, has long white hair on the head, the neck and the chin. Compare TEMMINCK *Esquisses Zool. sur la côte de Guiné*, pp. 21—24. —*Colobus Temminckii* KUHL, *Colobus fuliginosus* OGILBY, *Simia ferruginea* SHAW, also from the coast of Guinea.—*Semnopithecus Guereza, Colobus Guereza* RUEPPELL, *Abyssinische Wirbelth.* Tab. 1., P. GERVAIS in GUÉRIN, *Magas. de Zool.* 1836, *Mammif.* Pl. 18; Abyssinia; black, with long white hair along the sides and a white tail with a large brush of hair at the end.—*Colob. verus* V. BENEDEN, *Bullet. de l'Acad. de Brux.* V. 6.

Semnopithecus F. CUV. Fore feet pentadactylous, with thumb short. (The species known hitherto are all from Asia.)

Sp. *Semnopithecus nemæus, Simia Nemæus* L. (Mantiss. plant. 2, p. 521), BUFF. XIV. Pl. 41, AUDEB. *Singes*, IV. 1, Pl. 1, CUV. *Mamm.* (ed. 4to), Pl. 12; *le douc* BUFF.; a beautifully variegated monkey from Cochin-china, grey fore legs and tail white, hind legs black at the upper part, below the knees red-brown;—*Semnopithecus nasicus, Simia nasica* SCHREB., *Simia rostrata* BLUMENB., *Abb. Naturh. Gegenst.* No. 13, BUFF. *Suppl.* VII. Pl. 11, 12, AUDEB. *Singes*, IV. 2, Pl. 1, *Verhandel. over de Nederl. Bezittingen, Mamm.* Pl. 12, fig. 3 (the young animal), Borneo;—*Semnopithecus entellus* CUV., *Mammif.* (ed. 4to), Pl. 8, 9, CUV. *R. Ani., éd. ill., Mammif.* Pl. 13, fig. 1, Bengal, Assam;—*Semnopithecus cephalopterus, Cercopithecus cephalopterus* ZIMMERM., *Cercopithecus leucoprymnus* OTTO, *Nov. Act. Acad. Cæs. Leop. Carol.* XII. pp. 503—518 (with 2 Pl.); at Ceylon, where this species is named *Wanderoe* (see above *Cynocephalus Silenus*);—*Semnopithecus melanolophus, Simia melalophos* RAFFL., *Linn. Trans.* XIII. p. 40, GUÉR.

Iconogr., Mammif. Pl. 2, fig. 1 (and *Semnopith. flavimanus* Isid. Geoffr., Lesson *Centurie Zool.* Pl. 40), Sumatra, &c.

See on the stomach in this genus above, p. 579.

Hylobates Illig. Head small. Feet very long, the anterior, when the body is erect, touching the ground. Tail none.

The long-armed apes have been named Gibbons. They have a flat skull, large orbits and very large canine teeth, especially those of the upper jaw. To these belongs from further India *Hylobates albimanus, Simia lar* Gm. (*Homo lar* L. Mantiss. plant. 2, p. 521), Buff. xiv. Pl. 2 (and *Hylobates entelloides* Isid. Geoffr., *Arch. du Mus.* II. Pl. 1);—*Hylobates syndactylus, Simia syndactyla* Raffl., F. Cuv. *Mammif.* ed. 4to, Pl. 2, Guérin *Iconogr., Mammif.* Pl. 1, fig. 3; the *Siamang* at Sumatra, where also *Hylob. variegatus* Geoffr. (*agilis* F. Cuv.) occurs; at Borneo lives *Hylobates concolor;* at Java *Hylobates leuciscus* Kuhl, *Simia leucisca* Schr., Audeb. *Singes,* I. 2, Pl. 2; (comp. on this species Boie, *Isis,* 1828, s. 1027). These animals live in troops on the tops of trees in the mountains, and raise, especially towards morning, a loud, single-noted cry.

†† *Buttocks covered with hair.*

Simia Illig. Head large. Teeth, especially the canines, strong. Fore feet longer than hind feet, reaching beyond the knee when the body is erect.

Sp. *Simia satyrus* L. (exclus. of synonymes under β), the *orang-outan;* figures of the young animal are to be found in Vosmaer *Beschrijving van den orang-outang,* Amsterdam, 1778, 4to (copied in Blumenb. *Abb. Naturh. Gegenst.* No. 12), and in Audeb. *Singes,* I. 1, Pl. 2;—the best figure of adult animal in *Verhandel. over de Nederl. Overzeesche Bezittingen, Mamm.* Pl. 1. This ape occurs at Borneo and the eastern part of Sumatra. The hair is ruddy brown; the adult male has a projecting ridge behind the eyes along the jaws; the arms, when the animal is erect, reach nearly to the heels; often the thumb of the hind feet has no nail (which would seem, according to Swinton, to be peculiar to the female). On the upper arm the hair is, as usual, directed downwards, but on the fore-arm, from below upwards, which is also the case in the Chimpanzee, and, in the preceding genus, in *Hylobates syndactylus.* The resemblance of the orang to man has been exaggerated, and in this the skulls of younger individuals, which with less strongly developed face necessarily present a larger facial angle, have been compared with the human skull. At present it is known that the adult orang (*Simia Wurmbii*) possesses a skull of a peculiarly animal form. This ape lives in low marshy regions. In the wild state the orang eats chiefly fruits, especially figs, also fruit-buds and the young leaves of various shrubs. It forms for itself a kind of nest in trees, though not on the summit where it spends the day, but lower, about four feet from the ground. In its nest it covers itself with leaves of trees, and, being very sensible of cold, leaves its resting-place late in the morning, when the dew and vapours have been dispersed by the sun. The organs of sense, with

the exception of that of hearing, are not acute; the eye seems to be short-sighted. Except in the pairing season the old males live mostly alone; of the adult orangs on the contrary, and of the females, often two or three are found in company. The orang climbs rapidly, extending his hind legs far apart to grasp the branches; his progress on the ground is effected on the fore legs, the animal trailing his hind legs after him.

Compare on the orang, amongst others, P. CAMPER *Natuurkundige Verhandelingen*, Amsterdam, 1782, 4to, bl. 1—120, Pl. 1—4; F. CUVIER *Description d'un orang-outang et observ. sur ses facultés intellectuelles, Ann. du Mus.* XVI. pp. 46—65; RUDOLPHI *Ueber den Orang-outang und Beweis dass derselbe ein junger Pongo sei; Abhandl. der Akad. der Wissensch. zu Berlin*, a. d. J. 1824, s. 131—136; TIEDEMANN *Hirn des Orang-outangs mit dem des Menschen verglichen, Zeitschr. f. Physiol.* II. 1, 17—28, Tab. IV.; J. C. G. LUCÆ *Der Pongo- und Orang Schädel in Bezug auf Species und Alter, Abhandl. herausgegeb. von der Senckenb. Gesellsch.* Frankf. a. Main, 1854, s. 154—167; and especially S. MUELLER and H. SCHLEGEL in *Verhandel. over de nat. Gesch. der Nederl. Bezittingen, Zoogdieren*, bl. 1—28, and G. SANDIFORT *Ontleedk. Beschrijving.* ibid. bl. 29—56 (1840), and OWEN'S writings, referred to under the Chimpanzee.

Simia troglodytes BLUMENB., GMEL., BLUMENB. *Abbild. Naturh. Gegenst.* No. 11, GUÉR. *Iconogr., Mammif.* Pl. 1, fig. 2, CUVIER *R. Ani., éd. ill., Mammif.* Pl. 11; *Chimpanzee*, dark-brown hair, the arms reach to the knees only, the ears are very large; in the west of tropical Africa, at present driven further from the coast. Compare TYSON *Orang-outang sive Homo sylvestris, or the Anatomy of a Pigmie*, London, 1699, 4to.—W. VROLIK *Recherches d'Anatomie comparée sur le Chimpansé*, Amsterdam, 1841, folio (a capital work on the anatomy of monkeys in general), R. OWEN *On the Osteology of the Chimpanzee and Orang-utan, Transact. of the Zool. Soc.* I. 1855, pp. 343—379, Pl. 48—56.

Simia gorilla, Troglodytes gorilla SAVAGE and WYMAN, ISID. GEOFFR. SAINT-HILAIRE *Ann. des Sc. nat.*, 3ième Série, XVI. 1851, *Zool.* pp. 154—158, Pl. 7. This species (the largest of the apes) attains a length of full 5 feet, has short posterior limbs, smaller ears than the preceding species. The *gorilla* is found in the interior of Lower Guinea, near the line; this species, known to the Carthaginian voyager HANNO centuries before our era, was discovered not long ago by the missionary SAVAGE (*Boston Journal of Nat. Hist.* V. 1847, *Description of the characters and habits of Troglodytes Gorilla, and of the Osteology of the same*, with 4 plates; translated in *Ann. des Sc. nat.* l. l. p. 176 et suiv.). Compare OWEN *Osteol. Contributions to the Nat. Hist. of the Chimpanzee, including the Description of the skull of a large species, Troglodytes gorilla* SAVAGE, *Transact. of the Zool. Soc.* III. 1849, pp. 381—422, Pl. 58—63, *Description of the cranium of an adult male Gorilla*, &c. ibid. Vol. IV. Part 3, 1853, pp. 75—88; by the same, *Comparison of the skull of Troglodytes Gorilla with that of the Troglodytes niger, Catalogue of the osteol. series in the Coll. of Surgeons*, London, II. 1853, pp. 782—784, *and with that of a male Negro*, ibid. pp. 785—802; DUVERNOY *Des caractères anatomiques des grands Singes pseudo-anthropomorphes, Archives du Muséum d'Hist. natur.* Tome VIII. 1855, pp. 1—24, Pl. 1—16.

Order XII. *Bimanà.*

Incisor, canine, and molar teeth even, contiguous; molars equably enamelled; incisors four on each side. Feet pentadactylous, anterior limbs furnished with hands; nails all flat, broad. Gait erect.

Family XLVI. *Erecta.* (Characters of the order.)

Homo L. (Incisor teeth $\frac{4}{4}$, canines $\frac{1-1}{1-1}$, molars $\frac{5-5}{5-5}$; Dental formula Owen, i. $\frac{2-2}{2-2}$, c. $\frac{1-1}{1-1}$, p. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}=32$).

Sp. *Homo sapiens* L. (Nosce te ipsum).

Although man as a moral and reasoning creature is raised far above the animals, yet when his bodily structure is contemplated, no characters can be indicated which remove him from the class to which he is here referred. Man is distinguished from animals by an erect gait, for which even the monkeys that correspond to him most nearly in corporeal structure are unfitted, and which with him is the only natural one, since by it he preserves the free use of his hands. His hand is more unrestricted in the motion of the fingers, and is for him an *instrument of instruments*, as it was named by Aristoteles[1]. The brain has a great preponderance over the nerves and the spinal cord, of which the large amplitude of the human cranium as compared with the face is a consequence; man has the largest facial angle.

Man is further distinguished from animals by speech. All, even the least civilized peoples, have a language; it is the embodiment of the reason of man; words are forms of human thoughts; language is thus as much a property of man as is his understanding, although it may, no less than his understanding, be developed, enlarged and cultivated. Through it man possesses a history, a tradition of experience; a progressive education, which is imparted by this tradition to succeeding generations.

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[1] ἡ δὲ χεὶρ ἔοικεν εἶναι οὐχ ἓν ὄργανον ἀλλὰ πολλά· ἔστι γὰρ ὡσπερεὶ ὄργανον πρὸ ὀργάνων. *De partibus Animal.* IV. 108. Compare on the hand, as evincing design, the elegant Bridgewater treatise of the eminent physiologist Sir Charles Bell.

As man, in a greater degree than any other creature, is dispersed over the whole globe, there are numerous varieties also of the human genus which, at least in part, may be explained as the effect of climate and mode of life. The difference in different races of people has chiefly reference to the form of the skull, to the colour and the kind of hair. The five races of BLUMENBACH (*Varietas caucasia, mongolica, æthiopica, americana, et malaica*) do not include all these modifications. Natural history affords, in our judgment, no foundation for the adoption of different *human species;* another question of an historical nature, whether all men have spread over the earth from a single point and from a single ancestral pair, is beyond its province, and it can only offer a judgment as to the greater or less probability of such an origin.

Man appeared upon the surface of the earth at a later period than the animal species of which the remains are met with in the tertiary deposits.

Compare on the natural history of man, amongst others, J. F. BLUMENBACH *De generis humani varietate nativa*, ed. 3 (ultima), Gottingæ, 1795, 8vo;—Ejusd. *Decades craniorum diversarum gentium* VI. Gottingæ, 1790—1820; *Nova Pentas Collectionis suæ craniorum*, ibid. 1828.—STANHOPE SMITH *Essay on the causes of the variety of complexion and figure in the Human Species*, Philadelphia, reprinted Edinburgh, 1788, 8vo;—G. F. LUDWIG *Grundriss der Naturgeschichte der Menschenspecies*, Leipzig, 1796, 8vo;—PRICHARD *Researches into the Physical History of Mankind*, 4 Vols. with engravings, London, 1841, 8vo (3d. ed.); J. C. NOTT and G. R. GLIDDON *Types of Mankind, or Ethnological Researches, illustrated by selections from the inedited papers of* S. G. MORTON, London, 1854, 4to.

EXPLANATION OF PLATES.

PLATE. I. VERTEBRATE ANIMALS. FISHES.

Fig. 1. Plan of the circulation of the blood, after VON BAER, *Vorlesungen über Anthropologie,* Tab. IV. fig. 4. The heart is represented as divided into two portions at a distance from each other; I. II. the venous heart—I. the right auricle; II. the right ventricle; III. IV. the arterial heart—III. the left auricle; IV. the left ventricle. The course of the blood is indicated by the arrows. The upper half of the figure shews the motion of the blood through the respiratory organs; the lower half the course through the body, in which the arterial blood becomes venous. Compare p. 3.

Fig. 2. Brain of *Lophius piscatorius,* natural size, seen from above. I. Anterior cerebral lobes or hemispheres of the *cerebrum.* II. Middle cerebral mass, *corpora quadrigemina.* III. Posterior mass, *cerebellum.* A, *Hypophysis,* attached by a long pedicle. 1 First pair of cerebral nerves, &c. Compare pp. 43, 44. This as well as the following figures of this Plate are from nature.

Fig. 3. Perpendicular section of the basis of the skull of a new-born child, to shew the bodies of the three cranial vertebræ. In front of III. is the vomer or body of the fourth; see p. 8, nat. size.

Fig. 4. Skull of the pike, *Esox lucius,* half the natural size and seen from the side, to illustrate the osteology of fishes: compare pp. 18—23. For more convenient comparison, the bones are marked with the same cyphers as those used by CUVIER in the skeleton of the perch in his *Hist. nat. des Poissons,* but the small size of the figure does not allow all the cyphers to be given. Those noted are 1 the frontal bone, the *frontale posterius* of

CUVIER, 6 the sphenoïd bone, 11 the great ala of the sphenoïd, 12 the *os mastoideum;* of the suspensory bones of the lower jaw, the *epi-tympanicum* 23, the *os-tympanicum* 27, the malar bone 26 (*hypotympanic* OWEN). Behind these is placed the gill-cover, namely: 30 *præoperculum,* 28 *operculum,* 32 *sub-operculum,* 33 *interoperculum.* Of the bones of the face, 19 is the first of the sub-orbital bones, 17 the intermaxillary bone, 18 the superior maxillary bone, 18′ accessory bony plate, 22 (omitted in fig. it is the bone seen in shadow behind the upper part of the superior maxillary) the palate bone, 34 the dental portion of lower jaw.—37, 38 The two flat bony pieces (*cornua* of the hyoïd bone), to which the rays of the branchiostegous membrane 43 (here fourteen in number) are attached; 40 bone connecting the cornua with the body of the hyoïd bone; 41 *glosso hyale;* 42 the unpaired bony plate which runs backwards from the tongue-bone.

Fig. 5. Scale of a pike, magnified about 7 diameters, compare p. 46. The posterior margin *a* of the free edge of the scale is smooth. Consequently the scale belongs to the *cycloidea* of AGASSIZ; compare p. 81.

Fig. 6. Scale of a perch, similarly magnified, the posterior margin *a* is provided with numerous spines. This figure illustrates the *ctenoides* of AGASSIZ, compare p. 130.

PLATE II. FISHES, *continued.*

Fig. 1. Gills and heart of a perch in the natural position, seen from the left side and somewhat from below.

The gill-cover and gill-rays have been removed; *a,* the heart; *b,* the four branchial arches of the left side, from without; *c,* the inferior margins of the gills of the right side seen from within. Compare p. 33.

Fig. 2. Stomach and pyloric appendages of the cod, *Gadus morrhua.* The duodenum and posterior extremity of the stomach are laid open. In the former are seen four openings of the cœcal appendages. Compare pp. 25—27.

Fig. 3. Head of *Petromyzon fluviatilis* seen from above; *a,* the unpaired nostril on the middle of the head. See pp. 57, 60.

Fig. 4. *Amphioxus lanceolatus*, after JOHN MUELLER *Ueber den Bau u. die Lebenserscheinungen des Branchiostoma lubricum*, Tab. I. fig. 1; twice the natural size.

Fig. 5. Heart of *Squatina vulgaris*, pp. 65, 66. B, ventricle; C, muscular appendage of the heart with three rows of valvular projections; *a*, valves at the upper margin of the appendage. See p. 60.

Fig. 6. Head of *Sphyra* or *Zygæna Blochii* CUV., p. 68, from Java; one-fourth the natural size, seen obliquely from below; *a*, *a*, the five branchial apertures on the right side; *b*, *b*, the eyes; *c*, *c*, the nostrils.

Fig. 7. Heart of *Orthragoriscus mola*, p. 78, half the natural size. A, auricle; B, ventricle laid open; at the deep part of it is seen the transverse-opening of the auricle, provided with valves; *a*, *à*, semilunar valves at the upper part of the heart (*à*, one of the two small accessory valves); C, bulb of the aorta, formed of elastic tissue. Compare p. 75.

PLATE III. FISHES, *continued and concluded.*

Fig. 1. Skeleton of the Perch, *Perca fluviatilis*, p. 200, reduced, after CUVIER *et* VALENCIENNES *Hist. nat. des Poiss.* Pl. I., as an example of an *Acanthopterygian*. The anterior rays of the dorsal fin P *d*, are spinous; P *c*, is the caudal fin; P *a*, the anal fin; P *p*, the pectoral fin; P *v*, the ventral fin. Compare pp. 16, 17.

Figs. 2 and 3. Gills of the *Lophobranchii*, pp. 75, 76.

Fig. 2. A. Head of *Syngnathus acus*, p. 77, seen from the left side; *a*, the small branchial aperture. Fig. 2, B, the same head from below; on the right side the gill-cover has been removed, and there the clustered gills *a* are seen; below them is a partition which closes the branchial cavity behind; behind this in the middle is situated the heart *b*. Fig. 3 (copied from H. RATHKE *Untersuchungen über den Kiemenapparat*, Taf. IV. fig. 2). A, a gill magnified; on it two rows of short gill-leaves may be seen; B, one of these gill-leaves apart, more highly magnified.

Fig. 4. Upper jaw of *Diodon bicolor*, II. p. 79, from a preparation in the collection of comparative anatomy at Paris, to illustrate the characters of the *Pectognathi*, comp. p. 77; *a*, superior maxillary bone; *b*, intermaxillary bone; *c*, rough surface

corresponding to another on the superior maxillary bone a', which has been removed to the side and figured apart.

Fig. 5. Head of *Anableps tetrophthalmus*, p. 95.

Fig. 6. *Chironectes pictus*, p. 141.

Fig. 7. Head of *Osphromenus olfax*, after CUVIER *et* VALENCIENNES, l. l. Pl. 205, to shew the convoluted appendages above the gills, which are here exposed, pp. 201, 202.

PLATE IV. REPTILES.

Fig. 1. Heart with the origin of the arteries of a Crocodile or Caïman, *Crocodilus sclerops*, p. 315. R, O, right auricle which on the anterior or ventral surface covers a large part of the right ventricle. L, O, left auricle, smaller and placed more on the dorsal surface. In front of the ventricles is placed a large arterial sac; from this 5 stems arise; 1, pulmonary artery; 2, descending aorta, which curves behind the *trachea* or the left *bronchus;* 3, left branch of the ascending aorta; 4, right branch of the ascending aorta; 5, most to the right side, a second descending aorta which curves over the *trachea* or over the right *bronchus*. Thus the two stems, 2 and 5, forming an arterial ring round the œsophagus, descend and unite to form the *aorta abdominalis*. The right stem 4 of the ascending aorta forms the subclavian artery in this species only; from the left stem, on the contrary, of the ascending aorta the *arteria carotis a, c*, arises, which, only when it has reached the base of the cranium, divides into a right and left carotid. Compare pp. 217, 218.

Fig. 2. Posterior surface of the skull of *Rana cutipora* DUM. *et* BIBR. p. 250, the left side omitted, natural size, to shew the two occipital condyles ††, one of the characters of the *Reptilia diplopnoa*. * The auditory ossicle of the right side, which extends from the *fenestra ovalis* to the tympanic membrane.

Fig. 3. Skull of a young *Crocodilus biporcatus*, also seen from behind. † Unpaired occipital condyle, one of the characters of the *Reptilia haplopnoa*, p. 255.

Fig. 4. Skull of *Trigonocephalus rhodostoma*, p. 261, as an example of the venomous serpents; *k*, the quadrate bone; *l* external,

m internal pterygoïd bone; *r*, superior maxillary bone with a poison-tooth in use, and another in the living animal concealed in the gum and turned backwards, which, when the first falls out, is destined to take its place.

Fig. 5. Right superior maxillary bone of *Naja tripudians*, p. 263; *b* and *r*, as in the preceding figure.

Fig. 6. Anterior part of the bony head of *Python molurus*, p. 277; *b*, anterior frontal or lateral ethmoïd bone; *t*, nasal bone; *q*, intermaxillary bone; *r*, superior maxillary bone; *l*, attached to it, the anterior extremity of the external pterygoïd bone.

Fig. 7. Skull of *Dipsas dendrophila*, p. 266, seen from above; *a*, *a*, frontal bones; *b*, *b*, anterior frontal bones or lateral ethmoïd bones; *f*, parietal bone; *g*, *g*, *ossa mastoïdea*; *k*, *k*, quadrate bones; *t*, *t*, nasal bones; *w*, lower jaw.

Fig. 8. Right upper jaw-bone of the same species, the posterior tooth is grooved. See this last magnified, Fig. 8 *a*.

Fig. 9. Left upper jaw of *Python molurus* (see fig. 6) seen from below; *m*, *r*, as in fig. 4; *n*, palate-bone.

Fig. 10. Skull of *Amphisbæna alba*, p. 281; *k*, as in figs. 4 and 7.

Fig. 11. The anterior extremity of the skull of a Caïman, *Crocodilus sclerops* (p. 315) after Cuv. *Ann. du Mus.* x. Pl. i. fig. 16; *, fourth tooth of the lower jaw, of which the apex is received in a cavity of the upper jaw.

Fig. 12. Skull of the Gavial, *Crocodilus gangeticus*, p. 316, after Cuv. *Ann. du Mus.* xii. Pl. i. Fig. 6; *a*, *a*, intermaxillary bones; *b*, *b*, superior maxillary bones; *c*, *c*, malar bones; *i*, *i*, lachrymal bones; *h*, *h*, anterior frontal bones; *h'*, *h'*, posterior frontal bones; H, proper frontal bone; *m*, parietal bone; between it and the frontal bone are seen the large round apertures which distinguish the skull of the crocodiles, and especially of the gavials from that of the caïmans; through these apertures are seen the internal pterygoïd bones *f*, *f*; *n*, *n*, squamous bones (*ossa squamosa*), mastoïds Owen. Figs. 11 and 12 are reduced.

Fig. 13. Skull of a young *Crocodilus biporcatus* (p. 315), *, fourth tooth of the lower jaw which is received in a notch on the outer margin of the upper jaw. In the lower jaw is seen *y*, the articular portion; *x*, the coronoid bone, surangular Ow.; *v*,

angular bone; *u*, dental bone, dentary Ow. The other letters correspond with the same in fig. 12.

Fig. 14. Right half of the lower jaw of *Iguana delicatissima* (*Iguana nudicollis*), p. 305. The attachment of the teeth to the inside of the margin of the jaw is seen, p. 298; *z*, *os complementarium*, and *os operculare;* the other letters correspond to those of fig. 13.

PLATE V. REPTILES. *Continuation and conclusion.*

Fig. 1. Head of *Cœcilia hypocyanea* from a young individual. Behind the eye the branchial aperture * is seen, p. 238.

Fig. 2. Anterior portion of *Hypochthon xanthostictus* FITZ., p. 241; in front of the three-toed fore leg the large branchial tufts are seen.

Fig. 3. Anterior portion of *Amphiuma tridactylum*, p. 241.

Fig. 4. Full grown embryos of *Salamandra atra*, p. 242. A, such an embryo stretched out; B, an embryo folded, as it lies in the oviduct of the parent.

Figs. 5, 6, 7. Head of *Homalopsis angulata*, p. 268. Fig. 5 from the side; fig. 6 from above; fig. 7 head of another specimen of the same species from below: to explain the nomenclature of the scutes in the heads of serpents (see the note, p. 262), used by MERREM (*Systema Amphibiorum* Præfat. XII, XIII):

a. *Scutum vertebrale* (*scuta vertebralia*).
b, b. *Scuta occipitalia.*
c, c. *Scuta superciliaria.*
d. *Scuta temporalia.*
e, e. *Scuta frontalia posteriora.*
f. *Scuta frontalia anteriora* (only a single *scutum* in the figure drawn by us).
g. *Scutum rostrale.*
h. *Scuta ocularia posteriora.*
i. *Scuta ocularia anteriora* (*scutum oculare anterius*).
k. *Scuta lorea.*
m. *Scuta marginalia labii superioris.*
n. *Scutum labiale medium* (Fig. 7 N).
o. *Scuta labialia accessoria* (Fig. 7 O, O).
q. *Scuta mentalia* (Fig. 7 Q, Q).
r, r, r, r. *Scuta marginalia labii inferioris* (Fig. 7 R, R).

Fig. 8. Head of *Vipera palpebrosa*, p. 261.

Fig. 9. Tail of the same species seen from below (*Scuta subcaudalia integra*).

Fig. 10. Portion of the tail of *Homalopsis angulata*, p. 268, also seen from below (*Scuta subcaudalia divisa*).

Fig. 11. Head of *Amphisbæna alba*, p. 281.

Fig. 12. Head of *Chamæsaura anguina*, p. 290; *a*, eye with small ocular fissure between the eyelids; * external auditory aperture in front of the membrane of the tympanum; *b*, fore foot, not divided into toes.

Fig. 13. Right hind foot of *Platydactylus guttatus*, p. 311, seen from below; the thumb is destitute of nail.

Fig. 14. Hind legs and base of the tail of *Hemidactylus*, Cuv. II. p. 538, *Stellio platyurus* of Schneider, after a figure by him. Here the *pori femorales* may be seen, often noticed in the systematic arrangement of the *saurii*.

Fig. 15. Head and left fore leg of *Platydactylus vittatus*, p. 311.

Fig. 16. Tongue of *Varanus bivittatus*, p. 298.

Fig. 17. Tongue of *Tejus monitor*, p. 297; of nearly similar form to our lizards.

Fig. 18. Tongue of *Calotes gutturosus*, p. 308.

Fig. 19. *Chelonia imbricata*, p. 321, after Bell, *British Reptiles*. Except this figure, which is much smaller than the specimen, all the others are of the same size as the specimens, and drawn from them.

Plate VI. Birds.

Fig. 1. The skeleton of *Falco cœrulescens* of Java (p. 546), of natural size. A, the skull; B, the lower jaw; † the quadra tebone; C, the clavicle, *furcula;* O, coracoïd bone, or second clavicle; E, the cervical vertebræ; F, the dorsal vertebræ; H, the caudal vertebræ; L, the sternum; N, the scapula; P, the humerus; Q, the radius; R, the ulna; *i*, the hand (the letter is placed on the thumb); W, the thigh-bone (femur); *x*, the tibia; *y*, the fibula; *n*, single bone representing the root of the foot (*tarsus*) and fore foot (*metatarsus*); 1 thumb, 2 internal, 3 middle and 4 exter-

nal finger (pp. 329—333). The bones of the limbs of the right side are omitted in this figure.

Fig. 2. Sternum and clavicles of the same bird seen from before; C, C, O, O, L, as in the preceding figure.

Fig. 3. Skull of the ostrich, *Struthio camelus*, p. 417, from the side and reduced; *a*, frontal bone; *b*, nasal bones; *c*, superior maxillary bone; *d*, malar bone (*d'*, *quadrato-jugale*, squamosal Ow.); *e*, quadrate bone (tympanic Ow.); *e*, temporal bone (mastoïd Ow.); *f*, parietal; *g*, *g'*, occipital bone; *g'*, unpaired upper piece (*pars occipitalis*), *g*, lateral occipital (ex-occipital Ow.); *i*, intermaxillary bone; *k*, lower jaw composed of different bones (*u*, *v*, *x*, *y*, compare the skull of crocodile, Pl. IV); *l*, sphenoïd bone; † *foramen opticum*; *m*, anterior ala (orbito-sphenoïd Ow.).

Fig. 4. Connexion of the quadrate bone with the *os omoïdeum* on the inferior surface of the skull, in *Crax globicera*. Compare pp. 333, 334; *l*, sphenoïd bone; *o*, *os omoïdeum*; *p*, palate-bone; *q*, *q*, quadrate bone.

Fig. 5. A hen's egg that has been brooded about 24 hours, seen from above, but so that the section only of the shell and its membrane is represented; from V. BAER *Ueber Entwickelungsgesch. der Thiere*, I. Taf. III. fig. 3; *a*, the shell; *b*, the shell-membrane; *c*, boundary between the external and middle albumen; *c'*, *ligamentum albuminis* of TREDERN; *d*, boundary between the middle and internal albumen; *e*, *e*, *chalazæ*; *g*, boundary of the germ-membrane (*blastoderma*); *g*, *h*, the vitelline circle; *h*, boundary of the fœtal area; *h*, *i*, the vascular area; *i*, the space in which the *embryo* lies; this last is seen as a transverse streak in the middle of the space, pp. 351, 352.

Fig. 6. Eye of the swan, horizontal section, after D. W. SOEMMERRING, *a*, optic nerve; *b*, sclerotic; *c*, cornea; *d*, crystalline lens; *e*, *pecten*, pp. 365—367.

Fig. 7. Tongue of *Rhamphastos* (*lingua pennacea*) with the tongue-bone reduced, p. 446.

Fig. 8. Tongue-bone of *Pavo cristatus*, reduced, compare p. 364.

PLATE VII. BIRDS. Feet and heads as characters of certain families; almost all reduced, according to very different scales.

Fig. 1. Right foot of *Carbo*, p. 388.
Fig. 2. Left foot of *Larus*, p. 390.
Fig. 3. Right foot of *Ibis*, p. 402.
Fig. 4. Middle claw of the right foot of *Ardea*, p. 407.
Fig. 5. Right foot of *Gallus*, p. 426.
Fig. 6. Left foot of *Picus*, p. 457.
Fig. 7. Left foot of *Paralcyon*, p. 466.
Fig. 8. Right foot of *Cypselus*, p. 535.
Fig. 9. Right foot of *Caprimulgus*, p. 536.
Fig. 10. Right foot of *Haliaëtus*, p. 551.
Fig. 11. Bill of *Scythrops*, p. 452.
Fig. 12. Head of *Phœnicopterus*, p. 410.
Fig. 13. Head of *Pavo* (*muticus*), p. 424.
Fig. 14. Head of *Certhia*, p. 506.
Fig. 15. Head of *Anthus*, p. 518.
Fig. 16. Head of *Hirundo*, p. 534.

PLATES VIII. AND IX. MAMMALS.

Skulls.

The figures are drawn from specimens in the *Rijks-Museum*. Figs. 3, 5, 6 and 7 of Pl. IX. are of the natural size; the rest are reduced in the proportion indicated for each figure.

In all these figures *a* is the frontal bone; *b*, the nasal bone; *c*, the upper jaw-bone; *d*, the malar bone; *e*, the temporal bone; *f*, the parietal bone; *g*, the occipital bone; *i*, the intermaxillary bone; *k*, the lower jaw.

PLATE VIII.

Fig. 1. Skull of *Thylacinus Harrisii* $\frac{1}{8}$, p. 620.
Fig. 2. Skull of *Manis javanica* $\frac{2}{3}$, p. 661. Here no malar bone is seen, p. 571.
Fig. 3. Skull of *Delphinus tursio* $\frac{1}{6}$, p. 628.

Fig. 4. Skull of *Hyrax capensis* $\frac{2}{3}$, p. 636.

Fig. 5. Skull of *Arctomys monax* $\frac{1}{2}$, p. 692.

Fig. 6. Skull of the horse, *Equus Caballus* $\frac{1}{7}$, p. 639.

Plate IX.

Fig. 1. Skull of the Lama, *Camelus glama* $\frac{1}{4}$, p. 645.

Fig. 2. Skull of *Bradypus cuculliger* $\frac{2}{3}$, p. 664.

Fig. 3. Skull of the Hedgehog, *Erinaceus europæus*, p. 730.

Fig. 4. Skull of *Felis caracal* $\frac{1}{2}$, p. 704.

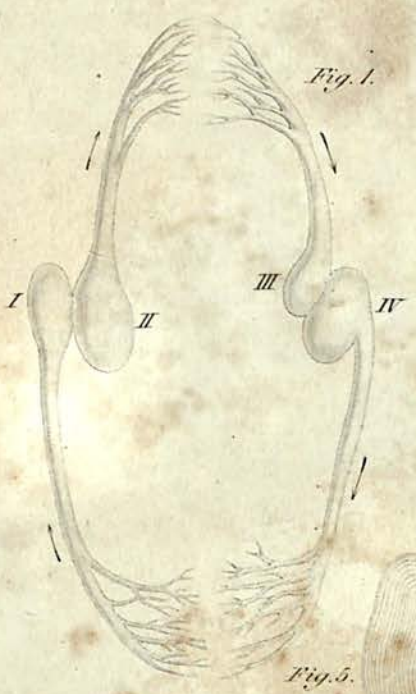
Fig. 5. Extremity of the lower jaw of *Galeopithecus variegatus*, p. 742, seen from above to shew the singularly notched incisor teeth.

Fig. 6. *a*, *b*, *Stenops javanicus*, p. 745.
a, lower jaw seen from above; six incisor teeth with two canines placed close at the sides of them; *b*, upper jaw, seen from before, two incisors and two canine teeth.

Fig. 7. Skull of *Stenops potto*, p. 745.

Fig. 8. Skull of *Hylobates leuciscus* $\frac{1}{2}$, p. 755.

Fig. 1.



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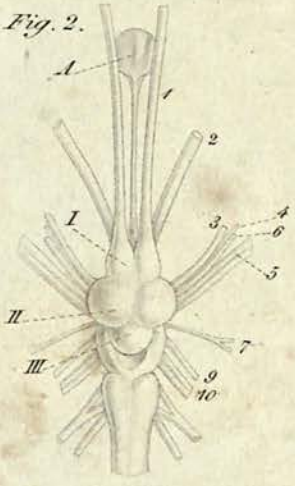

Fig. 5.

Fig. 6.

Fig. 3.

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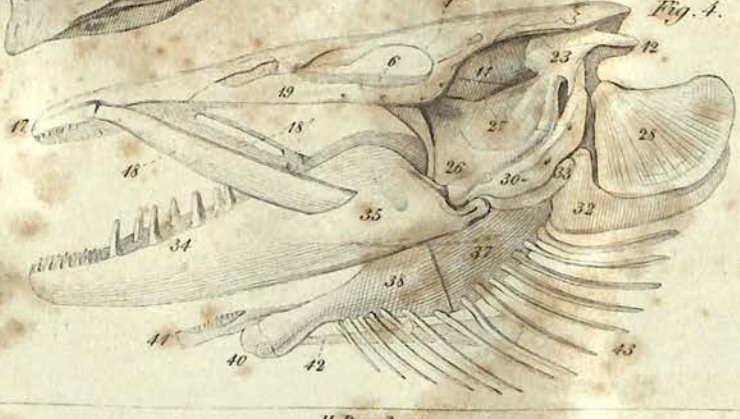

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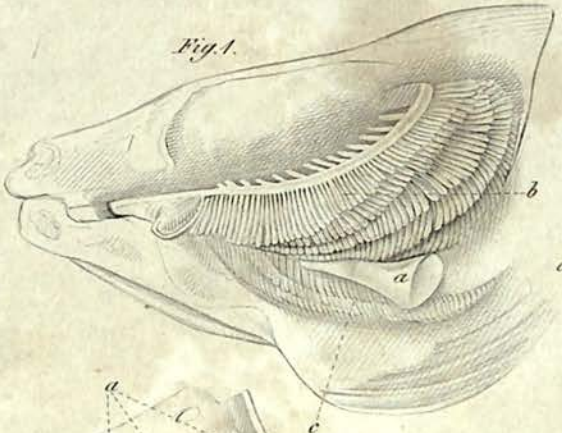

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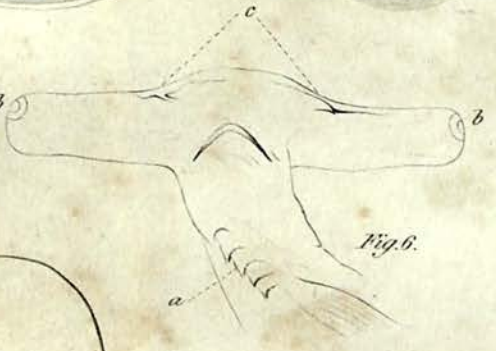

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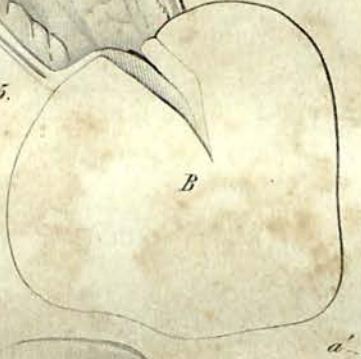

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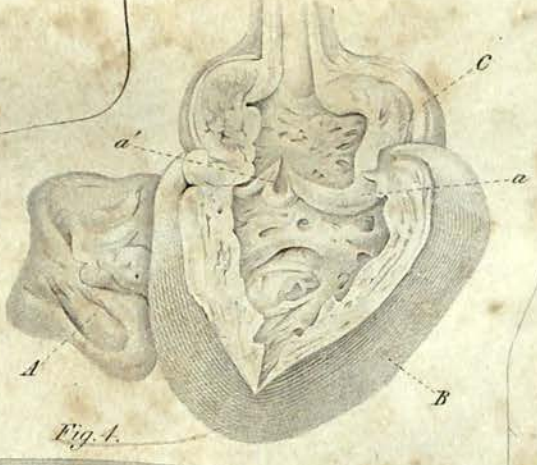
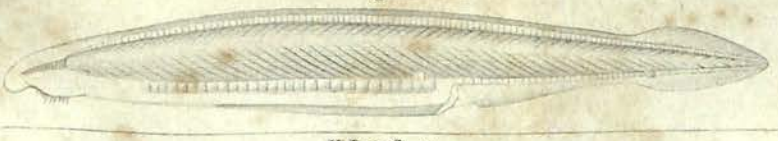


Fig.3.

Fig.4.



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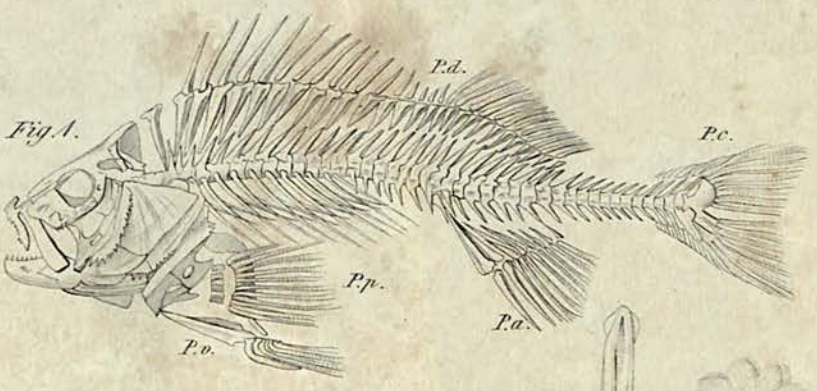

Fig.1.

Fig.2.A.

A

Fig.3.

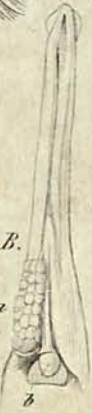

Fig.2.B.

B

Fig.4.

Fig.5.

Fig.7.

Fig.6.

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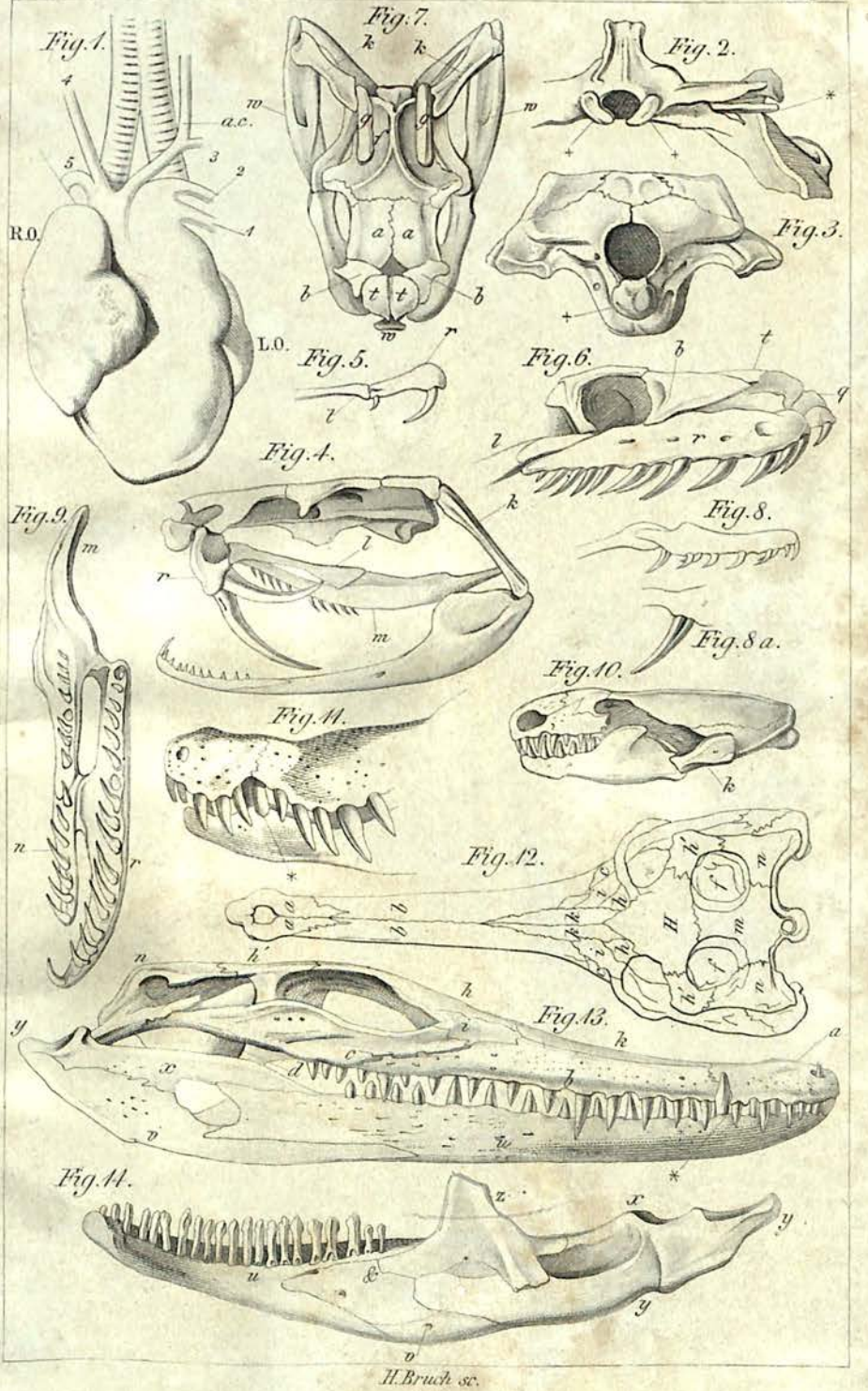
Fig.1.
Fig.7.
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Fig.8 a.
Fig.9.
Fig.10.
Fig.11.
Fig.12.
Fig.13.
Fig.14.
R.O.
L.O.
a.c.

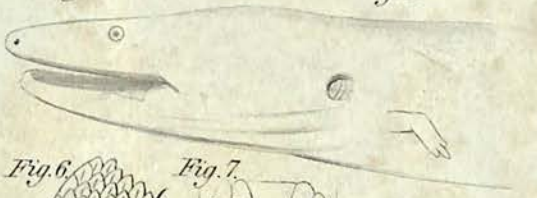
H.Bruch sc.

Fig.1.

Fig.2.

Fig.4 A.

Fig.4 B.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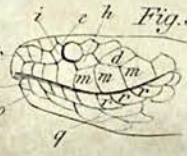
Fig.5.

Fig.6.

Fig.7.

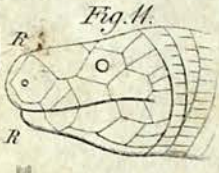
Fig.11.

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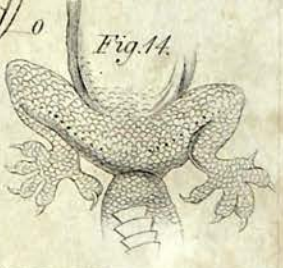
Fig.14.

Fig.12.

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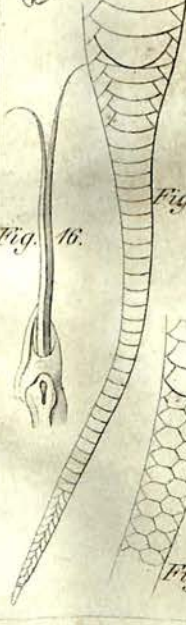
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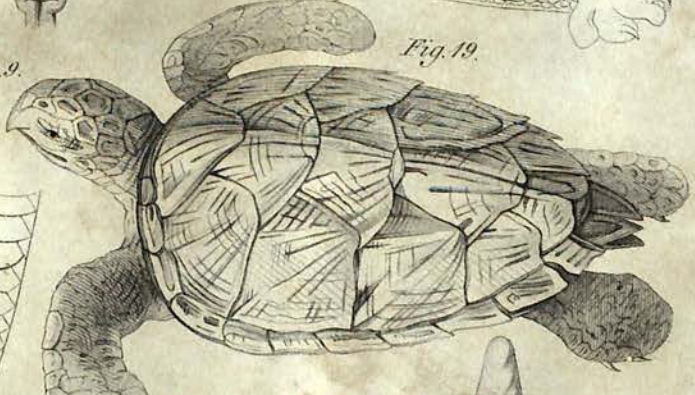
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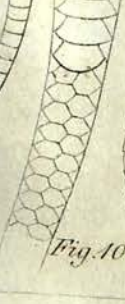
Fig.10.

Fig.18.

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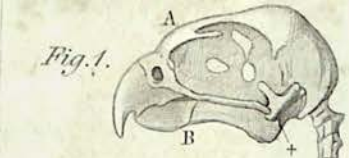

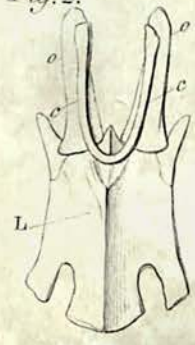

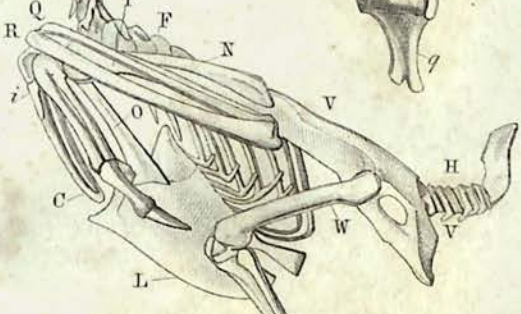

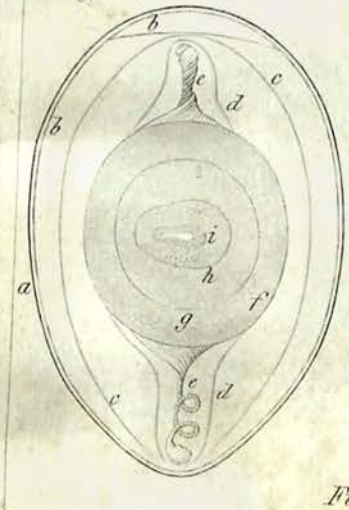

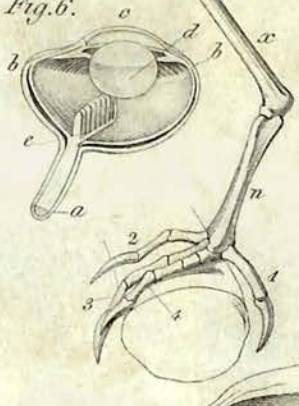

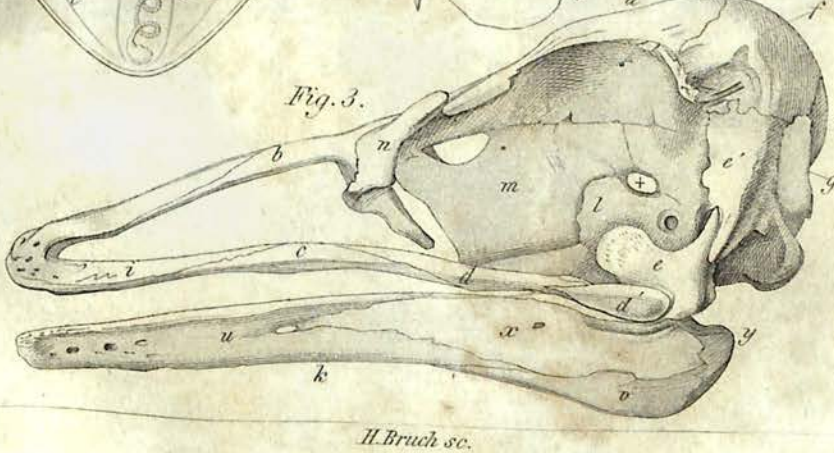

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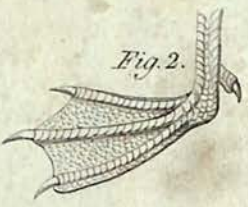
Fig. 2.

Fig. 7.

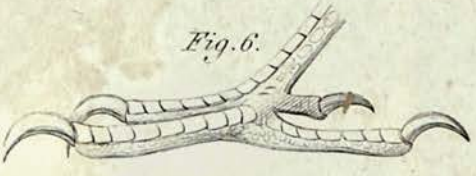
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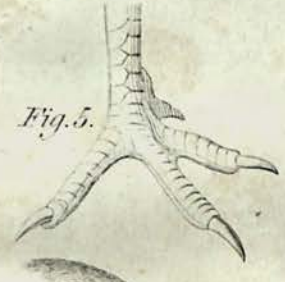
Fig. 9.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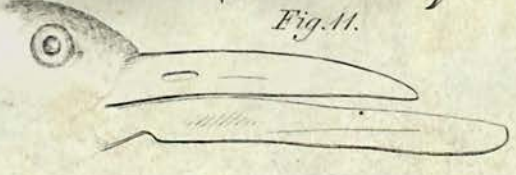
Fig. 11.

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Fig. 16.

Fig. 15.

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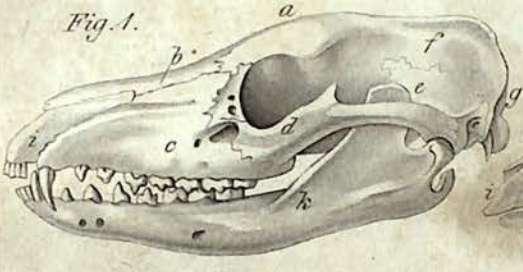

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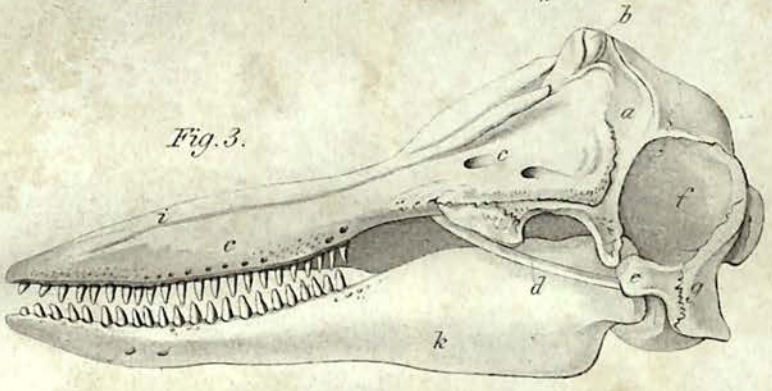

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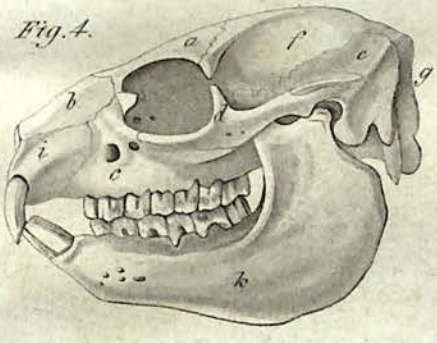

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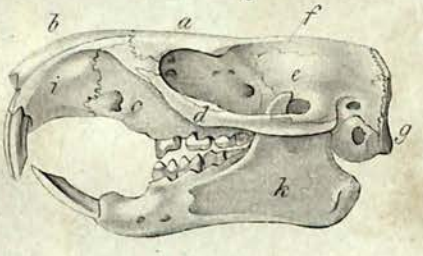

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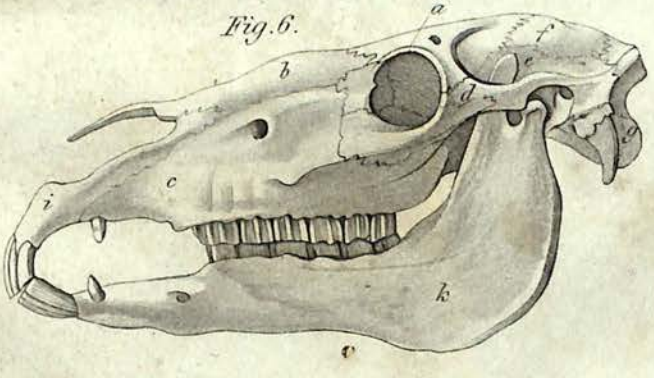

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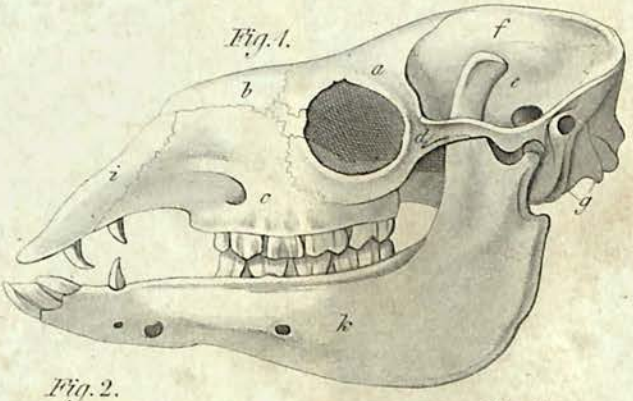

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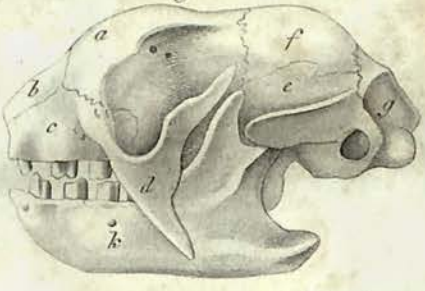
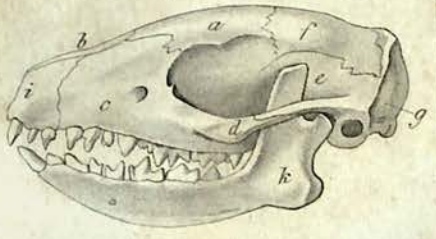


Fig.3.



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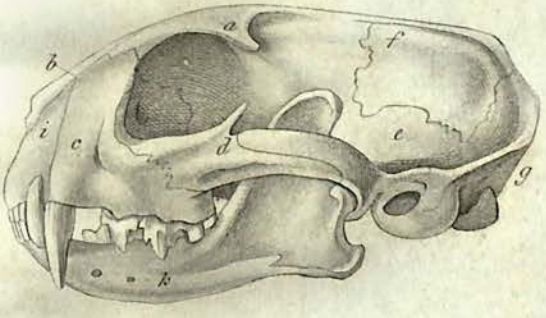

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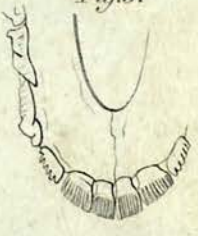

Fig.6 a.

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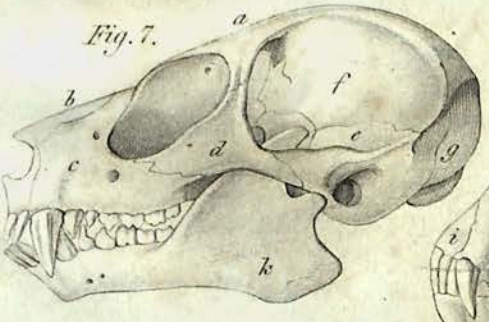

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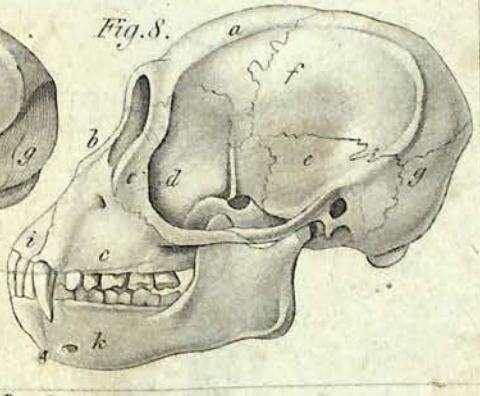

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